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OFFICE OF WATER RESEARCH AND TECHNOLOGY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 14
JULY 15, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior



VOLUME 13, NUMBER 14
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The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned-public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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SUBJECT INDEX

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

ROLE OF BOREHOLE GEOPHYSICS IN DEFINING THE PHYSICAL CHARACTERISTICS OF THE RAFT RIVER GEOTHERMAL RESERVOIR, IDAHO,
Geological Survey, Denver, CO. Water Resources Div.
W. S. Keys, and J. K. Sullivan.
Geophysics, Vol 44, No 6, p 1116-1141, June 1979. 26 Fig, 4 Tab, 11 Ref.

Descriptors: *Borehole geophysics, *Geothermal studies, *Groundwater, *Thermal water, *Idaho, Physical properties, Reservoirs, Logging(Recording), Deep wells, Computer models, Instrumentation, Borehole cameras, Radioisotopes, Raft River(Idaho).

Numerous geophysical logs have been made in three deep wells and in several intermediate depth core holes in the Raft River geothermal reservoir, Idaho. Laboratory analyses of cores from the intermediate depth holes were used to provide a qualitative and quantitative basis for a detailed interpretation of logs from the shallow part of the reservoir. A less detailed interpretation of logs from the deeper part of the reservoir is based on much less corroborative evidence. Extensive use was made of computer plotting techniques to arrive at some interpretations. Both the stratigraphic correlation utilizing a full suite of lots and the attitude of bedding calculated from acoustic televiewer logs indicate gentle dips throughout most of the reservoir with some local flexures. Televiewer logs permitted the location and orientation of numerous fractures and several features that may be faults. Temperature and flowmeter logs provide evidence that these fractures and faults are conduits that conduct hot water to the wells. One of the intermediate depth core holes penetrated a hydrothermally altered zone that includes several fractures producing hot water. This altered production zone could be distinguished by several logs. Borehole gamma spectrometry can be used to identify anomalous concentration of uranium, thorium, and potassium which are probably due to transportation by hydrothermal solutions. Computer crossplotting was used as an aid to the identification of such rock types as quartzite, quartz monzonite, and biotite schist in the deeper wells. Alteration of biotite schist to chlorite schist was also recognizable on these logs using computer-based analysis. Borehole geophysics not only provided much information on the Raft River geothermal reservoir but also permitted the lateral and vertical extrapolation of core and test data and bridged the gap between surface geophysical data and core analysis. (Kosco-USGS)
W80-04559

PERMITTIVITY OF ICE AND WATER AT MILLIMETER WAVELENGTHS,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 2C.
W80-04635

1B. Aqueous Solutions and Suspensions

PHYSICAL PROPERTIES OF CONFINED DREDGED MATERIALS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, K. W. Launius, and L. E. Deuel, Jr.
Soil Science, Vol 129, No 2, p 95-106, February 1980. 8 Fig, 2 Tab, 9 Ref. DACW39-75-C-0120.

Descriptors: *Dredging, *Physical properties, *Mineralogy, Slurries, Permeability, Shrinkage, Bulk density, Moisture content, Field capacity, Subsurface drainage, Plasticity index, *Dredged materials, *Confinement areas, Field-moisture data, Unsaturated permeabilities, Fine-grained-dredged materials, Volume changes, Moisture retention, Air drying.

Physical properties of fine-grained dredged materials from four diverse locations were determined. The results were useful to those involved in designing, managing, and reclaiming dredged-material-confinement areas. Many of the characteristics of the material were shown to undergo irreversible changes once the materials were dried. Initially, the material behaved like a slurry, but even after one drying, the properties changed so that the materials did not reswell to their original volume, the bulk density at a given moisture content was less, and the plasticity index was less. Physical properties of the materials were most closely correlated with mineralogy and the plasticity index. Those materials with smectitic minerals and greater plasticity indices retained greater amounts of water and had lower permeabilities than materials with other clays or lower plasticity indices. (Roberts-ISWS)
W80-04539

2. WATER CYCLE

2A. General

THE NORTH MAROONDAH EXPERIMENT PRETREATMENT PHASE COMPARISON OF CATCHMENT WATER BALANCES,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4A.
W80-04512

HYDROLOGY OF THE NAHANNI KARST, NORTHERN CANADA, AND THE IMPORTANCE OF EXTREME SUMMER STORMS,
Georgia Univ., Athens. Dept. of Geography.
G. A. Brook, and D. C. Ford.
Journal of Hydrology, Vol 46, No 1/2, p 103-121, March 1980. 9 Fig, 3 Tab, 8 Ref.

Descriptors: *Karst, *Canada, *Perched water, *Lakes, *Sinks, Groundwater movement, Subsurface drainage, Rhodamine, Tracers, Dyes, Springs, Rainfall, Hydrogeology, Caves, Geologic control, Hydrology, Surface-groundwater relationships, *Poljes, Flow conduits, Estavelles, Cols, Dolines, Ponors.

Discovered in August 1971, the Nahanni karst is the most complex high-latitude karst known. Mean annual temperature is -4.5C and precipitation 566 mm. The most spectacular landforms occur on a structural col (the 'north karst') connecting south Nahanni and Ram Plateau. Between July 19 and 31, 1972, an extreme summer storm deposited 224 mm of rain on the area. First, Second, and Third Poljes in the north karst flooded; maximum water depths were 8.5, 25, and 8 m, respectively, and Third Polje overflowed. The level of Raven Lake (0.25-0.5 km long) rose 49 m at an average 2.9 m per day. Flooding occurs through random perching of water above and below ground where conduits have been heavily alluviated. There is no highly integrated regional groundwater body; water moves along independent or poorly integrated conduits or multiple aquifers. Some depressions are inundated by groundwater entering through estavelles, others when surface and spring inputs exceed drainage. Although winter snowfall averages 213 cm, in most years spring snowmelt does not appear to cause prolonged flooding. However, it raises water levels in the aquifer leaving the area prone to flooding by frequent, intense summer rains. The magnitude and complexity of hydrologic activity in the subarctic Nahanni karst is remarkable, being comparable with that in tropical and temperate carbonate areas. (Visocky-ISWS)
W80-04513

RAINFALL INTERCEPTION IN A FOREST STAND ESTIMATED FROM GRASSLAND METEOROLOGICAL DATA,
Forest Research Inst., Christchurch (New Zealand).
A. J. Pearce, J. H. C. Gash, and J. B. Stewart.
Journal of Hydrology, Vol 46, No 1/2, p 147-163, March 1980. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Rainfall, *Interception, *Forests, *Model studies, Mathematical models, Meteorological data, Evaporation, Vegetation, Vegetation effects, Trees, Pine trees, Canopy, Precipitation(Atmospheric), Water loss, Meteorology.

Meteorological data collected over grassland were used in the Rutter and analytical interception models to predict interception losses for a Scots pine stand in Thetford Forest during 84 weeks in 1975 and 1976. Rutter and analytical model estimates using grassland data overestimated the observed losses by 37% and 25%, respectively; estimates using data collected over the forest overestimated by 8% and 5%, respectively. Systematic differences in the meteorological parameters controlling the evaporation rate from wet forest and wet grass are the cause of the overestimation of interception losses when grassland data are used in the models. Mean air temperature over the wet forest was 0.75C cooler, mean wet-bulb depression was 0.25C smaller, and mean vapor pressure deficit was 0.4 mbar smaller than the mean values observed over wet grass in 116 hr when more than 0.5 mm of rain fell at both observation sites. No significant differences between sites were found when both the grass and the forest canopy were dry. Regression equations for forest-site parameters on grassed-site parameters were used to adjust the grassed-site data for use in the models. Analytical model estimates using adjusted data were closely comparable to both observed losses and model estimates using above-forest data. Rutter model estimates using adjusted data were significantly different from the observed losses for 1976 and for the combined 1975-1976 data, but were comparable with the observed losses and model estimates using above-forest data in 1975. (Sims-ISWS)
W80-04514

USDAHL-74 MODEL AS A PLANNING TOOL,
Geological Survey, Towson, MD.
G. T. Fisher, J. E. Ayars, H. N. Holtan, and D. L. Nelson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1347-1352, November-December 1979. 7 Fig, 4 Tab, 7 Ref.

Descriptors: *Land use, *Planning, *Watersheds(Basins), *Runoff, *Maryland, *Model studies, Mathematical models, Urban runoff, Agricultural runoff, Pastures, Crops, Forest watersheds, Drainage, Mountains, Rainfall, Streamflow, Evaporation, Water resources.

The University of Maryland version of the USDAHL-74 model was used to simulate the hydrology of Maryland watersheds located in three different geologic provinces. The results of the simulation demonstrated the applicability of the model for use in evaluating the effects of changes in land use on diversified watersheds. (Sims-ISWS)
W80-04529

THE EFFECT OF ALTERED STREAMFLOW ON THE HYDROLOGY AND GEOMORPHOLOGY OF THE YELLOWSTONE RIVER BASIN, MONTANA,
Montana Dept. of Natural Resources and Conservation, Helena.
R. Koch, R. Curry, and M. Weber.
Yellowstone Impact Study, Technical Report No 2, 1977. 173 p, 38 Fig, 23 Tab, 73 Ref, 3 Append.

Descriptors: *Hydrology, *Channel morphology, *Montana, *River basins, *Watersheds(Basins), Rivers, Alluvial channels, Data collections, Streamflow, Flood frequency, Floods, Gaging stations, Sediment discharge, Diversion, Streambeds, Sediments, Discharge(Water), Distribution patterns, Regimen, Networks, Precipitation(Atmospheric), Shape, Meanders, Braiding, *Yellowstone River Basin(MT), Hydraulic geometry.

The impact of water development, in particular of a decrease in discharge, on the morphology and sediment transport of the Yellowstone River was the subject of this report. In the past, water use has increased slowly along the Yellowstone, the major

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demand being for irrigation. The impact on the bankfull discharge as a result of this type of development has been small. The sediment characteristics in the basin have been recently altered through the construction of Yellowtail Dam, which has decreased the sediment load of the Bighorn River as much as 80%. The levels of depletions considered in this report were small for the bankfull discharge; the relative impact was less for larger flows and greater for lesser flows. The changes in stage resulting from these changes in discharge would also be small, as would changes in width, depth, and velocity. The impact of changes in flow regime on sediment transport would be marked when the effect of this modification on total volume is considered. Perennial streams, particularly those that head in major mountain ranges in Wyoming and Montana, are amenable to predictable hydraulic geometry relationships. However, the small perennial and ephemeral streams in southeastern Montana do not bear the usual relationship between bankfull stage and recurrence interval. Instead of being characterized by a bankfull flow event on the average of once every 1.5 years like the regional perennial streams, the local ephemeral streams achieve that discharge only once every 15 to 25 years, or even less frequently. Additionally, the streams are highly irregular from site to site so that, for example, the ratio between the 25-year peak discharge and the 1.5-year peak discharge on streams of a fixed drainage size varies by a factor of as much as two orders of magnitude between sites separated by but tens of miles. (Humphreys-ISWS)
W80-04542

A PRACTICAL MODEL FOR LINEAR AND NONLINEAR RUNOFF,
Nebraska Univ. at Omaha. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04614

REGIONAL DROUGHT AND FLOOD FREQUENCY ANALYSIS: THEORETICAL CONSIDERATION,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
For primary bibliographic entry see Field 6A.
W80-04618

2B. Precipitation

RAINFALL INTERCEPTION IN A FOREST STAND ESTIMATED FROM GRASSLAND METEOROLOGICAL DATA,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 2A.
W80-04514

INSTANTANEOUS RAINFALL RATE: ITS MEASUREMENT AND ITS INFLUENCE ON HIGH-VOLTAGE TRANSMISSION LINES,
American Electric Power, North Liberty, IN.
For primary bibliographic entry see Field 7B.
W80-04538

A GENERALIZED PROBABILITY DENSITY FUNCTION FOR DOUBLE-BOUNDED RANDOM PROCESSES,
Institute of Hydraulics and Hydrology, Poondi (India).
P. Kumaraswamy.
Journal of Hydrology, Vol 46, No 1/2, p 79-88, March 1980. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Probability, *Stochastic processes, *Mathematical models, Rainfall, Runoff, Streamflow, Equations, Model studies, Statistics, Hydrology, Fitting functions, Probability density functions.

The author in 1976 developed the sinepower probability density function (SP-PDF) to fit up random processes which are bounded at the lower and upper ends, and which has a mode occurring between these two bounds. This latter condition is now relaxed, and a generalized PDF entitled double bounded probability density function (DB-PDF) was developed here. Methods for the application to practical problems of parameter estimation and to computer simulation of random variables were explained by a numerical example. (Sims-ISWS)
W80-04615

EFFECT OF SIMULATED ACID RAIN ON SULFATE MOVEMENT IN ACID FOREST SOILS,
Norwegian Forest Research Inst.
B. R. Singh, G. Abrahamsen, and A. Stuanes.
Soil Science Society of America Journal, Vol 44, No 1, p 75-80, January-February 1980. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Acidic water, *Soils, *Forest soils, Laboratory tests, Lysimeters, Acids, Acidity, Hydrogen ion concentration, Sulfates, Cations, Leaching, Chemicals, Vegetation effects, Soil science, Acid precipitation.

The effect of simulated acid rain on sulfate mobility in iron-podzol and semipodzol (Typic Udipsamments) forest soils of southern Norway was studied. The study was carried out with lysimeters with undisturbed soil. The lysimeters were watered with 'rain' having pH 5.6 and 4.3. It was found that sulfate mobility was higher in the semipodzol than in the iron-podzol, and it was dependent on their sulfate adsorption capacities which in their turn were dependent on A1 contents of these soils. Sulfate losses from applied 35S increased with increasing volume and decreasing pH of the 'rain'. The element losses were also higher in the semipodzol reflecting further higher mobility of sulfate in this soil. The total sums of cations, on equivalent basis, in the leachate from the semipodzol were nearly equal at pH 5.6 and 4.3 (0.480 and 0.485 meq/liter, respectively). In the iron-podzol, however, total sums of cations at pH 5.6 and 4.3 differed slightly (0.314 and 0.387 meq/liter, respectively). (Sims-ISWS)
W80-04640

2C. Snow, Ice, and Frost

GLACIER SURVEYS IN ALBERTA - 1977,
Inland Waters Directorate, Ottawa (Ontario).
I. A. Reid, and J. O. G. Charbonneau.
Report Series No 65, 1979, 17 p, 8 Fig, 19 Tab, 9 Ref, 2 Map.

Descriptors: *Athabasca Glacier, *Glaciers, *Hydrology, *Photogrammetry, *Mapping, *Aerial change, *Directional change, *Data collections, Saskatchewan, Canada.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulating effect on streamflow is diminishing. (WATDOC)
W80-04570

THE ACTIVE AND PASSIVE MICROWAVE RESPONSE TO SNOW PARAMETERS, 1. WETNESS,
Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
W. H. Stiles, and F. T. Ulaby.
Journal of Geophysical Research, Vol 85, No C2, p 1037-1044, February 20, 1980. 12 Fig, 3 Tab, 7 Ref. NASA/GSFC NAS 5-23777.

Descriptors: *Snow, *Moisture content, *Remote sensing, Radar, Microwaves, Variability, Diurnal, Equipment, Electronic equipment, Instrumentation, Snowpacks, Snow surveys, Water resources, Electrical engineering.

Diurnal observations of the variation of the radar backscattering coefficient, sigma o, and microwave apparent radiometric temperature, T sub ap, with snow wetness, m sub v, were presented. The results showed that sigma o decreases and T sub ap increases with m sub v, and that the magnitude of the sensitivity to m sub v increases with microwave frequency for both active and passive microwave parameters. Moreover, while the sensitivity of sigma o to snow wetness variations increases with angle of incidence, the sensitivity of T sub ap to snow wetness is approximately angle of incidence independent. (See also W80-04625) (Sims-ISWS)
W80-04624

THE ACTIVE AND PASSIVE MICROWAVE RESPONSE TO SNOW PARAMETERS, 2. WATER EQUIVALENT OF DRY SNOW,
Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
F. T. Ulaby, and W. H. Stiles.
Journal of Geophysical Research, Vol 85, No C2, p 1045-1049, February 20, 1980. 5 Fig, 2 Tab, 8 Ref. NASA/GSFC NAS 5-23777.

Descriptors: *Snow, *Moisture content, *Remote sensing, Radar, Microwaves, Mathematical models, Equipment, Electronic equipment, Instrumentation, Snowpacks, Snow surveys, Water resources, Electrical engineering.

Experimental measurements of the variation of the radar backscattering coefficient, sigma o, and microwave emissivity, epsilon, with water equivalent, W, of dry snow were presented and compared to predictions of simple semiempirical scattering and emission models. The results showed that sigma o and epsilon are generally dependent on the snowpack water equivalent as well as contributions by the underlying soil, and that the variation with W is a function of frequency and angle of incidence. (See also W80-04624) (Sims-ISWS)
W80-04625

LONG-PERIOD GRAVITY WAVES IN ICE-COVERED SEA,
Alaska Univ., Fairbanks. Geophysical Inst.
H. F. Bates, and L. H. Shapiro.
Journal of Geophysical Research, Vol 85, No C2, p 1095-1100, February 20, 1980. 1 Tab, 18 Ref, 1 Append. NOAA 03-5-022-55, NSF DPP78-01806.

Descriptors: *Gravity waves, *Ice cover, *Sea ice, *Model studies, Mathematical models, Cold regions, Oceans, Waves(Water), Theoretical analysis, Analytical techniques, Oceanography.

A floating ice sheet under compressive stress was modeled as a laterally compressed thin linearly elastic plate, floating on a compressible liquid of constant depth over a rigid bottom. This system was analyzed as a wave guide for plane waves. Sinusoidal traveling waves having vertical planes of constant phase were sought for the impulse response of the system. Two bands of gravity waves were found: (1) flexural and (2) floating-membrane. The two bands join at the critical frequency of the system, at which the impulse response is unbounded. The long-period floating-membrane gravity waves exist at all frequencies below the flexural gravity wave band. For long-period gravity waves the coupling force between plate and liquid was found to be a Hooke's Law force; the effective foundation modulus was directly proportional to the difference between the square of the phase velocity of a wave in the floating-plate system and that of a free-surface gravity wave at the same wavelength. The analogy of an elastic plate supported on an elastic foundation is apt for these long-period waves. It was concluded that the impulsive release of stored elastic energy when the compressed ice breaks supplies adequate energy to produce measurable long-period waves in floating ice. The results suggest

that long-period wave motion accompanies lateral compression of the ice sheet; hence wave measurements may provide a means of detecting the buildup of widespread compressive stress in the ice. (Sims-ISWS)
W80-04634

PERMITTIVITY OF ICE AND WATER AT MILLIMETER WAVELENGTHS,
Georgia Inst. of Tech., Atlanta.
M. D. Blue.
Journal of Geophysical Research, Vol 85, No C2, p 1101-1106, February 20, 1980. 4 Fig, 2 Tab, 7 Ref, 1 Append. NASA NSG-5082.

Descriptors: *Ice, *Water, *Electrical properties, *Microwaves, Refractivity, Reflectance, Measurement, Laboratory tests, Analytical techniques, Temperature, Model studies, Mathematical models, Permittivity, Dielectric properties.

Measurements of reflectivity of water and ice at 100 GHz, 140 GHz, and 180 GHz were reported. Measurements on water covered the temperature range 0C to 50C. No anomalies in the dielectric properties of water due to the presence of either salts or organic matter were found. The reflectivity of water and its temperature dependence were consistent with recent dielectric property models derived from data at other wavelengths. The index of refraction of fresh ice was constant at 1.78 throughout this region. (Sims-ISWS)
W80-04635

CRYSTAL ALIGNMENTS IN THE FAST ICE OF ARCTIC ALASKA,
Cold Regions Research and Engineering Lab., Hanover, NH.
W. F. Weeks, and A. J. Gow.
Journal of Geophysical Research, Vol 85, No C2, p 1137-1146, February 20, 1980. 10 Fig, 1 Tab, 8 Ref, 1 Append.

Descriptors: *Ice, *Sea ice, *Ice cover, *Crystals, *Alaska, *Arctic Ocean, On-site investigations, On-site collections, Sampling, Currents(Water), Ocean currents, Continental shelf, Cold regions, Crystal alignments, Fast ice.

Field observations at 60 sites located in the fast or near-fast ice along a 1200-km stretch of the north coast of Alaska between the Bering Strait and Barter Island have shown that the great majority of the ice samples (95%) exhibit striking c axis alignments within the horizontal plane. In all cases the degree of preferred orientation increased with depth in the ice. Representative standard deviations around a mean direction in the horizontal plane were commonly less than + or - 10 deg for samples collected near the bottom of the ice. At a given site the mean c axis direction may vary as much as 20 deg with vertical location in the ice sheet. The c axis alignments in the nearshore region generally paralleled the coast, with strong alignments occurring in the lagoon systems between the barrier islands and the coast and seaward of the barrier islands. In passes between islands and in entrances such as the opening to Kotzebue Sound the alignment was parallel to the channel. Only limited observations were available farther seaward over the inner (10- to 50-m isobaths) and outer (50-m isobath to shelf break) shelf regions. These indicated NE-SW and E-W alignments, respectively, in the Beaufort Sea north of Prudhoe Bay. (Sims-ISWS)
W80-04636

2D. Evaporation and Transpiration

RAINFALL INTERCEPTION IN A FOREST STAND ESTIMATED FROM GRASSLAND METEOROLOGICAL DATA,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 2A.
W80-04514

CONSTRUCTION AND PERFORMANCE OF LARGE AUTOMATIC (NONWEIGHING) LYSIMETERS,
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
G. A. Reichman, E. J. Doering, L. C. Benz, and R. F. Follett.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1343-1346, 1352, November-December 1979. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Lysimeters, *Evapotranspiration, *On-site investigations, *Irrigation effects, *Crop response, Infiltrometers, Soil water movement, Evaporation, Transpiration, Drainage systems, Measurement, Great Plains, Corn(Field).

The construction of 12 large, nonweighing lysimeters with automatic water table controls was described. Three distinct layers of the Hecla loamy fine sand profile were used to reconstruct the natural soil profile in the lysimeters. The controls are automatically operated with time clocks and float switches to maintain selected water table levels. The system is capable of replacing evapotranspiration losses of up to 2 cm every 24 h and of removing excess profile water of up to 4 cm per 24-h period. The performance of the system with respect to changes in water table elevation due to different precipitation and air temperatures was shown. The system has functioned satisfactorily for 4 yr with minimum attention and maintenance. (Adams-ISWS)
W80-04528

SIMULATION OF THE EFFECTS OF TRANSPIRATION LOSSES FROM THE UNSATURATED ZONE ON SEEPAGE FROM A SOIL SLOPE,
Jonkershoek Forestry Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 2G.
W80-04620

2E. Streamflow and Runoff

STOCHASTIC SYNTHESIS OF HYDROLOGIC DATA BASED ON CONCEPTS OF PATTERN RECOGNITION, I. GENERAL METHODOLOGY OF THE APPROACH,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Journal of Hydrology, Vol 46, No 1/2, p 5-34, March 1980. 9 Fig, 1 Tab, 45 Ref.

Descriptors: *Streamflow, *Discharge(Water), *Model studies, Mathematical models, Data processing, Statistics, Synthesis, Synthetic hydrology, Stochastic processes, Time series analysis, Rivers, Streams, Hydrology, Pattern recognition.

In stochastic models for streamflow synthesis no consideration is given to the presence of groups of data corresponding to wet and dry periods. The existence of such groups in geophysical records including hydrologic records was well emphasized by Hurst. This paper is the first in a series of three, which develops a feature synthesis model for hydrologic records utilizing properties assignable to groups and the concepts of pattern recognition. Part II will discuss the application of the model to natural streamflow records, and Part III will demonstrate the efficacy of the proposed model through testing the synthesized streamflows from the viewpoints of various statistical and hydrological tests. (Sims-ISWS)
W80-04510

WELSH FLOODPLAIN STUDIES, II. APPLICATION OF A QUALITATIVE INUNDATION MODEL,
University Coll. of Wales, Aberystwyth.
J. Lewin, and D. Hughes.
Journal of Hydrology, Vol 46, No 1/2, p 35-49, March 1980. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Floods, *Flood plains, *Rivers, *Model studies, Mathematical models, Flow, Streamflow, Water levels, Watersheds(Basins), Drainage, Topography, Hydrology, *Wales, *Dyfi River(Wales), *Teifi River(Wales).

The relationship of inundating waters to patterns of floodplain relief was assessed in terms of an inundation model involving types of input, output, and transfer processes. This model was applied to floods observed in the rivers Dyfi and Teifi in mid-Wales from 1973-1977. These showed complex patterns of actual inundation sequences, involving hysteretic effects in the relationship between river stage and flood extent, and varying effects arising from human floodplain modifications, different rates of stage fluctuation, and the local incidence of floodplain forms. Further sequential studies of inundation for contrasted floodplain types should allow better understanding of floodplain conductivity as an aid to flood-routing procedures and as a help in understanding discharge-inundation relationships. (Sims-ISWS)
W80-04511

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: IV. MODEL INPUTS AND VERIFICATION FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-04516

USDAHL-74 MODEL AS A PLANNING TOOL,
Geological Survey, Towson, MD.
For primary bibliographic entry see Field 2A.
W80-04529

COMPUTATION OF BED LOAD USING BATHYMETRIC DATA,
National Water Research Inst., Burlington (Ontario), Hydraulic Research Div.
For primary bibliographic entry see Field 2J.
W80-04534

DEBRIS FLOW ON PRISMATIC OPEN CHANNEL,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
T. Takahashi.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY3, Proceedings Paper 15245, p 381-396, March 1980. 9 Fig, 19 Ref, 2 Append.

Descriptors: *Open channel flow, *Debris avalanches, *Sediment transport, Boulders, Clays, Flocculation, Mudflows, Profiles, Sediments, Velocity, Viscosity, Hydraulics, Slurries, Resistance, *Debris removal, Granular media, Segregation, Prismatic channel.

Reviews on the yield strength and viscosity of the interstitial clay slurry in debris flow prove that ordinary debris flow may be modeled as a dilatant fluid in which the intergranular forces dominate. Theoretical velocity distributions in dilatant fluid compare well with the experimental results when the value of a numerical constant is appropriately selected. The longitudinal profile of the lobate snout is satisfactorily analyzed by applying the theory of one-dimensional translation wave on an open channel, where the resistance coefficient is a function of concentration, depth, and grain diameter. A remarkable segregation of particles, in which the larger ones move upwards, occurs in debris flow due to the effects of collisions of particles. The accumulation of boulders in the front part of debris flow is a result of the faster transportation of the larger particles in the upper layer of the flow than that of the smaller ones in the lower layer. (Lee-ISWS)
W80-04535

THE DESIGN OF A FLOOD FORECASTING PROCEDURE FOR THE KLANG RIVER AT KUALA LUMPUR,
Lincoln Coll. (New Zealand).
V. J. Bidwell.

Journal of Hydrology (New Zealand), Vol 18, No 1, p 29-35, 1979. 2 Fig, 1 Tab, 2 Ref.

Descriptors: *Flood forecasting, *Water levels, *Mathematical models, *Asia, Model studies, Rivers, Streamflow, Floods, Flood flow, Watersheds(Basins), Precipitation(Atmospheric), Rainfall, Precipitation excess, Hydrology, *Malaysia, *Klang River(Malaysia).

A procedure was required for forecasting the flood level of the Klang River at the city of Kuala Lumpur, Malaysia. Using data from rainfall stations and tributary river stages, one may predict flood stage by means of a multiple-input, autoregressive, moving-average linear model. This model was calibrated from storm records by means of stepwise multiple regression. The resulting set of equations was developed into a procedure for manual computation. (Sims-ISWS)
W80-04536

A SIMPLE DIGITAL RATE-METER FOR CURRENT METERS (NOTE),
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 7B.
W80-04537

THE EFFECT OF ALTERED STREAMFLOW ON THE HYDROLOGY AND GEOMORPHOLOGY OF THE YELLOWSTONE RIVER BASIN, MONTANA,
Montana Dept. of Natural Resources and Conservation, Helena.
For primary bibliographic entry see Field 2A.
W80-04542

FLOODS IN GEORGIA, MAGNITUDE AND FREQUENCY,
Geological Survey, Doraville, VA. Water Resources Div.
M. Price.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-146244, Price code: A13 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-137, October 1979. 269 p, 29 Fig, 6 Tab, 24 Ref.

Descriptors: *Floods, *Peak discharge, *Flood frequency, *Georgia, *Flood forecasting, Analytical techniques, Estimating, Flood recurrence interval, Gaging stations, Flood data, Rainfall-runoff relationships, Natural streams, Drainage area, River basins, Regression analysis, Model studies.

Regional relations are defined for estimating the magnitude and frequency of floods having recurrence intervals of 2, 5, 10, 25, 50, and 100 years on streams with natural flow in Georgia. Multiple-regression analyses were used to define the relationship between the flood-discharge frequency of annual peak discharges for streams draining 0.1 to 1,000 square miles and 10 climatological and physical basin characteristics. The analyses indicate that the drainage area of the basin is the most significant characteristic. Five regions having distinct flood-discharge frequency characteristics are delineated. Individual relations of flood magnitude and frequency to drainage area are given for parts of the main stems of the major rivers without significant regulation draining more than 1,000 square miles. (Kosco-USGS)
W80-04546

STATISTICAL SUMMARY OF STREAMFLOW DATA FOR KANSAS STREAMS IN THE MISSOURI RIVER BASIN,
Geological Survey, Lawrence, KS. Water Resources Div.
P. R. Jordan.
Kansas Water Resources Board, Streamflow Characteristics Technical Report No 14B, September 1979. 334 p, 14 Fig, 1 Tab, 2 Ref.

Descriptors: *Streamflow, *Flow duration, *Low flow, *High flow, *Kansas, Streams, Flow rates, Average flow, Gaging stations, Drainage area, Natural flow, Regulated flow, Basic data collections, *Missouri River basin(Kans).

Tables summarizing streamflow data are presented for each gaging station in the Missouri River basin in Kansas that had at least 1 year of record through 1976. These tables summarize daily streamflow as follows: (1) the number of days in each year that the daily discharge was between selected limits (duration tables), (2) the lowest mean discharge for selected numbers of consecutive days in each year, (3) the highest mean discharge for selected numbers of consecutive days in each year, and (4) for stations having at least 20 years of record, the percentage of days in each month when the discharge equaled or exceeded selected class limits (monthly duration tables). These summaries provide useful information for appraising and comparing the hydrologic characteristics of drainage basins, for classifications of streams for regulatory purposes, and for design of water-supply reservoirs and flood-control works. (Kosco-USGS)
W80-04550

PROBABLE HYDROLOGIC EFFECTS OF A HYPOTHETICAL FAILURE OF MACKAY DAM ON THE BIG LOST RIVER VALLEY FROM MACKAY, IDAHO, TO THE IDAHO NATIONAL ENGINEERING LABORATORY,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-04551

HYDROLOGIC AND HUMAN ASPECTS OF THE 1976-77 DROUGHT,
Geological Survey, Menlo Park, CA. Water Resources Div.
H. F. Matthai.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.25. Geological Survey Professional Paper 1130, 1979. 84 p, 30 Fig, 52 Ref.

Descriptors: *Hydrologic budget, *Droughts, *United States, *Groundwater, *Low flow, Withdrawal, Reservoir storage, Water shortage, Precipitation(Atmospheric), Water conservation, Water quality, Surface waters, Rationing(Water), Rural areas, Legal aspects, Land subsidence, Water management(Applied).

The drought of 1976-77 was the most severe in at least 50 years in many parts of the United States. Record low amounts of rainfall, snowfall, and runoff, and increased withdrawals of ground water were prevalent. The use of carry-over storage in reservoirs during 1976 maintained streamflow at near normal levels, but some reservoirs went dry or dropped below the outlet works in 1977. Carry-over storage in the fall of 1977 was very low. Ground-water levels were at or near record low levels in many aquifers, hundreds of wells went dry, and thousands of wells were drilled. Yet no wide-spread deterioration of ground-water quality was reported. Water-quality problems arose in some streams and lakes, but most were localized and of short duration. Water rationing became a way of life in numerous areas, and water was hauled in many rural areas and to a few towns. Water use was affected by legal agreements or decisions, some of which were modified for the duration of the drought, and by the inability of water managers to efficiently manage surface and ground waters as one resource under existing law. There are still many drought related problems to solve and many challenges to be met before the next drought occurs. The advancement of techniques in many fields of endeavor in recent years plus ongoing, planned, and proposed research on drought and the risks involved are promising thrusts that should make it easier to cope with the next drought. (Kosco-USGS)
W80-04552

MAINE COASTAL STORM AND FLOOD OF FEBRUARY 2, 1976,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Morrill, E. H. Chin, and W. S. Richardson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.00. Geological Survey Professional Paper 1087, 1979. 20 p, 10 Fig, 2 Plates, 5 Tab, 7 Ref.

Descriptors: *Maine, *Coasts, Storm surge, *Floods, *Tidal waters, High water mark, *Wind tides, Estuaries, Flood damage, New England, Documentation, Meteorological data, Hydrologic data, Drainage area, Streamflow, Sites, Maps, Currents(Water), Gaging stations, *Bangor area(Maine).

A business section of Bangor, Maine, was flooded with 12 feet (3.7 m) of water on February 2, 1976. The water surface elevation reached 17.46 feet (5.32 m) above national geodetic vertical datum of 1929 (NGVD), approximately 10.5 feet (3.2 m) above the predicted astronomical tide at Bangor. The unusually high water resulted from a tidal storm surge caused by prolonged strong, south-southeasterly winds which occurred near the time of astronomical high tide. Winds exceeded 64 knots off the New England coast. The resulting flood was the third highest since 1846 and is the first documented tidal flood at Bangor. This report documents the meteorological and hydrologic conditions associated with the flooding and also contains a brief description of storm damage from Eastport to Brunswick, Maine. Included are flood elevations in the city of Bangor and along the coast of Maine east of the Kennebec River. (Kosco-USGS)
W80-04553

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON RURAL UNREGULATED STREAMS IN NEW YORK STATE, EXCLUDING LONG ISLAND,
Geological Survey, Albany, NY. Water Resources Div.
T. J. Zembrzuski, Jr., and B. Dunn.
Geological Survey Water-Resources Investigations 79-83 (open-file report), 1979. 66 p, 5 Fig, 7 Tab, 24 Ref, 3 Append.

Descriptors: *Flood forecasting, *Peak discharge, *Floods, *Flood frequency, *New York, Streams, Analytical techniques, Flood recurrence interval, Regional analysis, Gaging stations, Regression analysis, Equations, Estimating, Drainage area, Precipitation(Atmospheric), *Log-Pearson type III statistics.

Techniques are presented for estimating the magnitude and frequency of floods at ungaged sites on unregulated rural streams in New York, excluding Long Island. The discharge-frequency data and basin characteristics of 220 stream-gaging stations in New York and adjacent States were used in developing multiple linear regression equations for floods ranging in recurrence interval from 2 to 100 years. Separate equations were developed for northern, southeastern, and western New York. Standard errors of estimate of the 100-year flood range from 32.9 percent in the southeastern region to 42.8 percent in the western region. Drainage area is the independent variable needed in all equations; other variables needed, depending on region, are main-channel slope, storage index, and mean annual precipitation. A method is given for obtaining improved discharge-frequency relationships at gaged sites by weighting log-Pearson type III and regression estimates according to their variances. Basin characteristics, log-Pearson type III statistics, and regression and weighted estimates of the frequency-discharge relationship, are tabulated for the gaging stations used in the regression analyses. (Kosco-USGS)
W80-04556

FLOOD HAZARD STUDY TALLASSEEHATCHEE CREEK AND TRIBUTARIES IN VICINITY OF JACKSONVILLE, ALABAMA.
Soil Conservation Service, Auburn, AL.
Report No ALA-OSPFP 100902, March 1980. p 64, 21 Fig, 6 Tab, 9 Ref, 3 Append. HUD P-1009.

Descriptors: *Alabama, *Flood profiles, *Flood data, *Flood plain zoning, Land use, Floodways, Flood data, Flood frequency, Topography, Water levels, Overflow, Streamflow, Floods, Flood damage.

Local flood problems and hazards are identified for the city of Jacksonville, Alabama, to serve as guidelines for local governments in the reduction of potential flood losses caused by unwise development in flood-prone areas. The area involved in the study includes 8 stream miles and drainage areas ranging from 0.7 to 9.5 sq mi for Tallasseehatchee Creek, 9.8 to 17.8 sq mi for Little Tallasseehatchee Creek, and 0.8 to 4.2 sq mi for the tributaries. The area has a humid and temperate climate with a yearly rainfall average of 53.24 in, generally well distributed throughout the year. Land use in the area includes cropland, pasture, woodland, residential, commercial, industrial, and roads. Rapid urbanization is producing increasing pressure for flood plain development. Reliable information on the flood history of the area is not available. Included in the report are Flood Hazard Area Photomaps, Flood Profiles, Discharge-Elevation-Frequency Data, and Floodway Data for streams. Regulatory and corrective measures to minimize the risk of flooding are discussed along with pertinent existing State and local flood-prone area regulations. With present conditions a 100-year flood would damage approximately 484 acres while a 500-year flood would damage approximately 560 acres. Projected urban growth along the streams studied is expected to cause significant change in flood levels along the main streams. (Seigler-IPA)
W80-04611

STOCHASTIC SYNTHESIS OF HYDROLOGIC DATA BASED ON CONCEPTS OF PATTERN RECOGNITION, II. APPLICATION OF NATURAL WATERSHEDS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Journal of Hydrology, Vol 46, No 3/4, p 197-217, April 1980. 7 Fig, 5 Tab, 9 Ref, 2 Append.

Descriptors: *Streamflow, *Synthetic hydrology, *Model studies, Mathematical models, Watersheds(Basins), River flow, Rivers, Flow, Drainage, Stochastic processes, Analytical techniques, Equations, Hydrology, Pattern recognition.

The feature synthesis model was utilized to synthesize streamflow realizations from three natural rivers. The practical usefulness of the various techniques employed in consonance with the application of the model was explained with illustrative examples dealing with streamflow records. The salient peculiarities associated with the construction and operation of the model for streamflow synthesis were presented. (See W80-04510 and W80-04613) (Sims-ISWS)
W80-04612

STOCHASTIC SYNTHESIS OF HYDROLOGIC DATA BASED ON CONCEPTS OF PATTERN RECOGNITION, III. PERFORMANCE EVALUATION OF THE METHODOLOGY,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Journal of Hydrology, Vol 46, No 3/4, p 219-237, April 1980. 4 Fig, 7 Tab, 6 Ref.

Descriptors: *Streamflow, *Synthetic hydrology, *Statistics, *Model studies, Mathematical models, Evaluation, Water levels, Flow, River flow, Analytical techniques, Methodology, Hydrology, Statistical methods, Pattern recognition.

Synthetic realizations of monthly streamflows obtained by utilizing a feature synthesis model were tested from statistical and hydrological viewpoints. In terms of statistical considerations the synthetic realizations were shown to possess relevant properties of the historical streamflows at the series level as well as at the monthly level. From hydrological considerations, the synthetic realizations were found to be embedded in properties that are associated with clusters of low flows and clusters of peak flows that are comparable to those in the historical sample. The model results suggested that the synthesis of streamflows based on concepts of pattern recognition is a potentially viable approach and warrants further investigation. (See also W80-04612) (Sims-ISWS)
W80-04613

A PRACTICAL MODEL FOR LINEAR AND NONLINEAR RUNOFF,
Nebraska Univ. at Omaha. Dept. of Civil Engineering.
W. F. Rogers.
Journal of Hydrology, Vol 46, No 1/2, p 51-78, March 1980. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Runoff, *Peak discharge, *Model studies, Mathematical models, Discharge(Water), Drainage, Base flow, Rainfall, Watersheds(Basins), Storms, Storm runoff, Hydrographs, Hydrology.

Second-order standardized peak discharge distribution was defined as the log of peak discharge divided by runoff volume in inches squared regressed on log runoff volume in inches. The slope of this distribution is -1.0 for linear basins and less than -1.0 for nonlinear drainage basins. High r sq-values indicate runoff volume alone accounts for an average of 86% of the variation in the dependent variable. Because most drainage basins exhibit nonlinear second-order peak dischage distribution, this model is useful in predicting peak discharges for rainfall and runoff events of any duration, spatial distribution, or uniformity; and no separation of base flow is necessary. The effect of any antecedent moisture condition appears to be evaluated. The regression slope of this peak discharge distribution model is a drainage basin characteristic. Basins with similar slopes should be homogeneous. (Sims-ISWS)
W80-04614

A GENERALIZED PROBABILITY DENSITY FUNCTION FOR DOUBLE-BOUNDED RANDOM PROCESSES,
Institute of Hydraulics and Hydrology, Poondi (India).
For primary bibliographic entry see Field 2B.
W80-04615

ADAPTIVE FOURIER ANALYSIS OF PERIODIC-STOCHASTIC HYDROLOGIC SEQUENCES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol 46, No 3/4, p 239-249, April 1980. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *Streamflow, *Rivers, *Model studies, Mathematical models, Stochastic processes, Fourier analysis, Time series analysis, Correlation analysis, Flow, River flow, Water levels, Discharge(Water), Watersheds(Basins), Drainage, Hydrology, Autocorrelation.

General formulation of adaptive parameter and state estimations was fully developed on the basis of Kalman filters, given a periodic-stochastic model coupled with an observation model. It was successfully applied to decompose a given monthly flow sequence into periodic and stochastic components. The results showed a definite advantage of using adaptive Fourier analysis over conventional analysis. (Sims-ISWS)
W80-04616

CRITICAL DROUGHT ANALYSIS OF PERIODIC-STOCHASTIC PROCESSES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol 46, No 3/4, p 251-263, April 1980. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Droughts, *Low flow, *River flow, *Streamflow, *Model studies, Mathematical models, Stochastic processes, Analytical techniques, Methodology, Flow, Probability, On-site data collections, Monthly, Measurement, Hydrology, *Turkey.

A general method was presented for finding the exact probability distribution function of the longest drought duration in a finite sample of any process on the basis of runs theory and enumeration technique. The methodology developed was applied to some hypothetical and observed monthly river flow sequences at various parts of Turkey. (Sims-ISWS)
W80-04617

SEDIMENT LOADS OF NORTH ISLAND RIVERS, NEW ZEALAND--A RECONNAISSANCE,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W80-04644

TURBULENCE PREDICTION IN OPEN CHANNEL FLOW,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R-M. Li, J. D. Schall, and D. B. Simons.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15347, p 575-587, April 1980. 5 Fig, 2 Tab, 10 Ref, 2 Append. NSF ENG 76-02896.

Descriptors: *Open channel flow, *Turbulence, *Model studies, *Flow characteristics, Turbulent flow, Mathematical models, Dispersion, Diffusion, Theoretical analysis, Analytical techniques, Steady flow, Statistical methods, Laboratory tests, Velocity, Fluctuations, Measurement, Instrumentation, Anemometers, Hydraulics, Probability, Rough boundary, Smooth boundary.

An analytical model for predicting turbulent intensities of velocity for the streamwise and cross-streamwise directions in open channel flow was derived. Due to the random nature of turbulence, a probabilistic approach to the problem is required. A Gaussian distribution was assumed to describe the turbulent fluctuating velocities. From this basic condition, a three-parameter model was derived to predict the root-mean-square (rms) values of turbulence for the vertical and longitudinal directions. Values calculated from the mathematical model were compared to experimentally obtained data using hot-film anemometry techniques, and excellent agreement existed for both components of rms. Field data should be tested to provide a more definite evaluation of the universality of the model. (Humphreys-ISWS)
W80-04645

THE RIVER LAXA ECOSYSTEM, ICELAND,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
P. M. Jonasson.
Oikos, Vol 32, No 1-2, p 306-309, 1979. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *River Laxa(Iceland), *Ecosystems, *Gradients(Streams), *Rivers, Lake Myvatn(Iceland), *Ecological distribution, Spawning, *Powerplants, Fluvial sediments, Upstream, Surface waters, Watersheds(Basins), Fish stocking, River flow, Profiles, Slopes, Zoobenthos, Salmon, Trout, Streams, Iceland, Chironomids, Oligochaetes.

The River Laxa, Iceland, originates in Lake Myvatn and flows into the Atlantic Ocean. It is 58 km long and flows through two different topographic areas: the upper steep part, where the river flows rapidly and where sedimentation does not occur; and the lower part where the slope is gentle, the river flow is slower and sedimentation occurs. A powerplant is located at the juncture of these two stretches. Transport of organic material produced in Lake Myvatn amounts to an average 600 kg dry weight/sec. Downstream movement of organic matter declines rapidly from 3.68 mg dry weight/l near the lake to 2.56 mg dry weight/l about halfway down the river to 1.15 mg dry weight/l near the entry into the ocean. A sharp reduction in chlorophyll occurs in the upper river. The upper river is abundant in Simuliidae, Hydra, Plumatella, chironomids and oligochaetes. Quantitative measures of zoobenthos were not made. However, high concentrations of ducks and trout feeding on zoobenthos in the uppermost reaches of the river indicate that zoobenthos is abundant

there. The lower river is an outstanding salmon river with the highest average catch of 2,200 individuals/year, and the highest average weight of 5.0 kg for Salmo salar L. in Iceland. Since the salmon cannot pass the canyon at the power plant and reach the upper river, the upper reaches have trout, Salmo trutta L. instead. The experimental release of salmon parr in the upper river proved successful, probably because the lava blocks forming the river bed at those locations are a favorable salmon habitat. (Harris-Wisconsin)
W80-04663

ANALYSIS OF STRUCTURAL AND NONSTRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-04772

2F. Groundwater

AQUIFER COEFFICIENTS DETERMINED FROM MULTIPLE WELL EFFECTS, FERNANDINA BEACH, FLORIDA,
Geological Survey, Jacksonville, FL. Water Resources Div.
C. B. Bentley.
Ground Water, Vol 17, No 6, p 525-531, November-December 1979. 6 Fig, 3 Tab, 4 Ref.

Descriptors: *Aquifer characteristics, *Artesian wells, *Florida, *Water level fluctuations, Pumping, Observation wells, Confined water, Groundwater, Drawdown, Transmissivity, Storage coefficient, Groundwater recharge.

On September 30, 1977, a large industrial plant in Fernandina Beach, Florida, shut down six artesian wells that had been pumping continuously for several weeks from the Floridan aquifer. Two wells continued pumping until November 20, 1977, at which time the shutdown wells were restarted. A water-level recorder on an observation well recorded the changing water level following shutdown and startup. Pumping rates of the wells ranged from 400,000 to 590,000 cubic feet per day. Distances from the pumped wells to the observation well range from 660 to 7,920 feet. Analysis of the water-level data was complicated because the wells were neither turned off nor restarted simultaneously; during recovery one well was restarted and pumped for several hours; and at the beginning of startup, a well that had been pumping continuously during the shutdown was turned off. The Cooper-Jacob graphical method, based on the principle of superposition and using values of specific drawdown or specific recovery and weighted logarithmic mean of the distance squared divided by time was applied to determine the aquifer coefficients for the upper water-bearing zone of the aquifer. A transmissivity of 30,000 feet squared per day and a storage coefficient of between 0.00025 and 0.0004 were computed. (Kosco-USGS)
W80-04554

AQUIFERS IN WALWORTH COUNTY, SOUTH DAKOTA,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04555

ROLE OF BOREHOLE GEOPHYSICS IN DEFINING THE PHYSICAL CHARACTERISTICS OF THE RAFT RIVER GEOTHERMAL RESERVOIR, IDAHO,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 1A.
W80-04559

HYDROLOGY AND SURFACE MORPHOLOGY OF THE BONNEVILLE SALT FLATS AND PILOT VALLEY PLAYA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. C. Lines.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Geological Survey Water-Supply Paper 2057, 1979. 107 p, 47 Fig, 7 Tab, 39 Ref.

Descriptors: *Hydrology, *Lake morphology, *Great Salt Lake, *Utah, *Playas, Deserts, Topography, Salinity, Hydrologic budget, Climatology, Groundwater, Aquifer characteristics, Brines, Potash, Mud flats, Groundwater recharge, Discharge(Water), Water chemistry, Evaporation, *Bonneville Salt Flats(Utah), *Pilot Valley(Utah).

The salt crust on the Bonneville Salt Flats, Utah, has been used for many years for racing and for the production of potash. There is a conflict between users, as the salt crust has diminished in size. Brine in the shallow sediments is drained into ditches adjacent to the Bonneville Racetrack, and the brine is used to produce potash. Because brine is extracted from leased Federal and State lands and from privately owned land, there is also concern as to whether minerals were being extracted from unleased Federal and State lands. A hydrologic study indicates that the Bonneville salt crust is being affected by a number of factors including (1) natural climatic cycles, (2) extraction of brine from the ditches, and (3) manmade surface-drainage barriers (tailings piles along ditches and highway roadfills) and ponding areas where sediment is accumulating on the surface of the salt crust. Remedial measures that are evaluated include (1) construction of subsurface barriers, (2) construction of new and alteration of old surface-drainage barriers, (3) cease brine withdrawals in areas near the Bonneville salt crust and move ditch systems further from the salt-crust area, and (4) replace the salt removed by the brine-collection ditches with salt stored in the evaporation ponds used to produce the potash, or with salt from some other source. (Kosco-USGS)
W80-04563

GROUND-WATER BASIC DATA FOR RANSOM AND SARGENT COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04564

HYDROGEOLOGIC AND GEOCHEMICAL INVESTIGATION OF THE BOONE-ST. JOE LIMESTONE AQUIFER IN BENTON COUNTY, ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Geology.
A. E. Ogden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175177, Price codes: A09 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center University of Arkansas Publication No 68, 1980. p 143, 36 Fig, 5 Tab, 69 Ref, 3 Append, 2 Maps. OWRT A-044-ARK(1).

Descriptors: *Arkansas, *Aquifer characteristics, *Hydrogeology, *Groundwater, Water quality, Well data, Limestones, Permeability, Specific capacity, Transmissivity, Karst hydrology, Caves, Groundwater recharge, Water pollution, Water table aquifers.

Results from thirty-nine pumping tests and well samples were used to study the hydrogeology and hydrochemistry of an important shallow, surface exposed aquifer in northwest Arkansas, the Boone-St. Joe limestone aquifer. The aquifer has two formations, the upper Boone Limestone, and the lower St. Joe Limestone. Parameters determined by the pumping tests include permeability, coefficient of transmissibility, and specific capacity. Coefficient of transmissibility results varied from 24.8 to 24,640 gpd/ft and specific capacity ranged from 0.03 to 30 gpm/ft showing a large range in production capability. Results also indicate that choosing well sites along photo-lineaments is not as reliable for the Boone-St. Joe aquifer as for other karstified carbonate aquifers. Six classes of aquifer conditions were identified for the Boone-St. Joe: (1) wells intersecting caves with rapid recharge; (2) wells intersecting caves with slow recharge; (3) aquifer permeability charges within the saturated zone; (4) delayed yield or leaky conditions; (5) wells intersecting recharge boundaries; and (6) wells in homogeneous aquifer conditions. Groundwater from the aquifer is poor showing high fecal streptococcus counts and high levels of nitrates, chloride, phosphate and sulfate. (Seigler-IPA)
W80-04603

A FINITE-ELEMENT MODEL FOR CONCURRENT CONFINED-UNCONFINED ZONES IN AN AQUIFER,
Indian Inst. of Tech. Madras. Hydraulic Engineering Lab.
K. Elango, and K. Swaminathan.
Journal of Hydrology, Vol 46, No 3/4, p 289-299, April 1980. 10 Fig, 2 Tab, 7 Ref, 1 Append.

Descriptors: *Finite element analysis, *Aquifers, *Confined water, *Groundwater, Mathematical models, Steady flow, Dupuit-Forchheimer theory, Anisotropy, Heterogeneity, Equations, Permeability, Saturated flow, Galerkin technique.

The numerical simulation of the situation of concurrent confined and unconfined zones in a groundwater aquifer system was carried out by using the finite-element method with four-sided mixed-curved isoparametric elements. The model was limited to the steady state and was based on Dupuit's assumptions. The results of the model for a test situation indicated that the model can be used for prediction of the occurrence of unconfined regions around over-pumped wells in an originally confined aquifer of which the interfaces between the confined and unconfined regions may be estimated. (Visocky-ISWS)
W80-04619

THE INTERPRETATION OF TRITIUM IN THE CHALK UNSATURATED ZONE,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
S. S. D. Foster, and A. Smith-Carington.
Journal of Hydrology, Vol 46, No 3/4, p 343-364, April 1980. 8 Fig, 4 Tab, 20 Ref.

Descriptors: *Tritium, *Limestones, *Unsaturated flow, *Fallout, Nuclear explosions, Rainfall, Sampling, Groundwater movement, Soil profiles, Pore water, Solutes, Depth, Porosity, Boreholes, Soil moisture, Moisture content, *Chalk aquifer, *England.

Pore-water tritium profiles from the Chalk unsaturated zone were presented, and the problems and limitations in their interpretation were evaluated in detail. A new model of the physicochemical behavior of tritium in the soil zone was proposed, which can account for the quantity and distribution of thermonuclear tritium observed at shallow depths in the unconfined Chalk aquifer. The mechanisms of solute movement through the Chalk unsaturated zone were also discussed. (Visocky-ISWS)
W80-04621

EFFECT OF CLIMATE AND TEMPERATURE ON THE AMOUNT OF HC03(-) AND H2C03 OF GROUNDWATERS (INFLUENCE DU CLIMAT, DE LA TEMPERATURE SUR LA TENEUR EN HC03(-) ET H2C03 DES EAUX SOUTERRAINES),
H. J. Schoeller.
Journal of Hydrology, Vol 46, No 3/4, p 365-376, April 1980. 2 Fig, 17 Ref.

Descriptors: *Groundwater, *Water quality, *Aquifers, *Model studies, Mathematical models, *Analysis, Analytical techniques, Aquifer characteristics, Temperature, Evapotranspiration, Ions, Calcium, Carbonates, Bicarbonates, Hydrogeology, Limestones, Saturated soils, Arid climates, Climates, Humid climates, Cold regions, Unsaturated soils.

An equation was developed that demonstrates the influence of P sub C02, Ca(2+), T, ionic strength, and complex ions on the amount of HC03(-) in

groundwater. Other constraints are the rate of C02 generation in the soil zone, its behavior in the unsaturated and saturated zones, and the hydrodynamic characteristics of the aquifer. In a limestone aquifer in humid regions, HC03(-) water increases slightly toward the areas of warmer temperatures, and also within the same region the HC03(-) decreases as the altitude increases. The HC03(-) concentration in a dolomitic terrane may be lower than that found in a limestone aquifer in a cold region. In arid climates the mineral content of the water increases which results in higher ionic strengh and HC03(-) concentration due to the rapid rate of evapotranspiration. However, the previous conclusions do not apply when the concentration of Ca(2+) is high, or undersaturation of CaC03 occurs, or for water in terranes of siliceous or silicate rocks. Thus, in a statistical method to describe the relationship between climate and HC03(-) of water, all of the above considerations have to be considered. (Humphreys-ISWS)
W80-04623

HYDROGEOLOGY OF THE PEERLESS LAKE AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 7C.
W80-04646

2G. Water In Soils

CONSTRUCTION AND PERFORMANCE OF LARGE AUTOMATIC (NONWEIGHING) LYSIMETERS,
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
For primary bibliographic entry see Field 2D.
W80-04528

RESPONSE FUNCTIONS APPLIED TO A DRAINAGE SYSTEM,
National Council for Scientific Research, Lusaka (Zambia).
T. C. Sharma.
Journal of Hydrology, Vol 45, No 3/4, p 279-287, February 1980. 2 Fig, 5 Ref.

Descriptors: *Theoretical analysis, *Agricultural runoff, *Mathematical studies, *Drainage systems, Drainage, Infiltration, Runoff, Analysis, Soil water movement, On-site data collections, *Response functions, Functions.

Response functions such as the impulse, step, and frequency functions may be useful as performance parameters for agricultural land drainage systems. Mathematical expressions have been developed for these response functions from the discrete dynamic representation of a drainage system. (Adams-ISWS)
W80-04530

PHYSICAL PROPERTIES OF CONFINED DREDGED MATERIALS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 1B.
W80-04539

SIMPLE FIELD METHODS FOR ESTIMATING SOIL HYDRAULIC CONDUCTIVITY,
Sao Paulo Univ. (Brazil). Center for Nuclear Energy in Agriculture.
For primary bibliographic entry see Field 7B.
W80-04540

PHYSICAL PROPERTIES OF SOIL MOISTURE,
North Dakota Univ., Grand Forks. Dept. of Physics.
J. W. Harrell, and F. L. Howell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175367, Price codes: A03 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University, Fargo. Research Project Technical Completion Report, December 1979. p 36, 16 Fig, 14 Ref. OWRT A-051-NDAK(3).

Descriptors: *Kaolinite, *Montmorillonite, *Clays, *Soil moisture, *Soil physical properties, Calcium, Sodium, Soil water movement, Soil water, Moisture content, Analytical techniques, Diffusion, Centrifugation, Tritium, Correlation analysis.

Proton NMR and diffusion coefficient measurements were used to study the mobility of sorbed water in Na- and Ca-montmonillonite, Na-and Ca-hectorite, and untreated kaolin. Clay samples were obtained from Ward's Natural Science Establishment, Inc. The montmorillonite and hectorite were saturated by adding a two molar chloride salt solution of either Na or Ca followed by three cycles of shaking, centrifuging, and pouring off the supernatant. Two hydrating methods were used. In the first samples were saturated and air dried while in the second saturated samples were equilibrated at a fixed moisture tension. Sample measurements taken include relaxation rate, pulse gradient diffusion, and tritium diffusion. Results show the measured room temperature spin-lattice, T(1), and spin-spin relaxation time, T(2), as functions of water content at room temperature. For montmorillonite T(1) and T(2) increase with water content with larger relaxation times in sodium clay when moisture is above 80%. Montmorillonite and hectorite had qualitatively similar temperature dependent spin-lattice relaxations. Correlation frequencies for the proton motion from these values were intermediate between those for pure water and ice. Mean proton jump distances were calculated from two to three times the diameter of a water molecule. For kaolin, T(1) and T(2) increase with water content. (Seigler-IPA)
W80-04606

SOIL-WATER RETENTION, TRANSMISSION, AND QUALITY OF LEACHATE FROM POLYMER-TREATED SOILS, EFFECTS OF THE IN SITU CROSSLINKING,
North Dakota State Univ., Fargo. Dept. of Soils.
J. L. Richardson, S. P. Pappas, E. J. Deibert, and Z. W. Wicks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175342, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University Research Project Technical Completion Report, October 1979. p 12, 4 Append. OWRT A-059-NDAK(1).

Descriptors: *Soil amendments, *Soil properties, *Polymers, *Erosion control, Clays, Loam, Silts, Infiltration, Aggregates, Slope stabilization, Permeability, Soil stability, Soil texture, Soil treatment.

Clay, silt loam, and fine sandy loam were treated with various two-phase crosslinkable polymer systems and with polyvinyl alcohol (PVA) to study their effects on selectd soil characteristics. Surface samples of the three soil types were taken in North Dakota and were analyzed for primary particles size distribution, natural water stable aggregate size distribution, percent organic carbon, and percent calcium carbonate equivalent. Samples were then treated with a variety of types and concentrations of amines and aldehydes of the two-phase crosslinkable polymer system. Some samples were treated with PVA and water to compare treatment effectiveness and to serve as a control. Following treatment four basic tests to determine the quality of soil aggregates on natural soils were preformed: (1) plant available water holding capacity; (2) saturated hydraulic conductivity; (3) water stable aggregate size distribution; and (4) water drop penetration tests to measure water repellency. Results show that the degree of aggregation increases with higher molecular weights and amine/aldehyde system concentrations especially for silts and sands, however, at lower concentrations PVA was more effective than the polymer systems. Variable results were observed for plant water available according to treatment, concentrations and soil type. None of the polmer systems treated cause water repellency but some PVA treated soils moderately repellent. (Seigler-IPA)
W80-04609

SIMULATION OF THE EFFECTS OF TRANSPIRATION LOSSES FROM THE UNSATURATED ZONE ON SEEPAGE FROM A SOIL SLOPE,
Jonkershoek Forestry Research Station, Stellenbosch (South Africa).
P. A. Kilpatrick.
Journal of Hydrology, Vol 46, No 3/4, p 301-309, April 1980. 4 Fig, 3 Tab, 3 Ref.

Descriptors: *Model studies, *Transpiration, *Seepage, *Unsaturated flow, Soil water movement, Streamflow, Mathematical models, Numerical analysis, Finite element analysis, Porous media, Hydraulic conductivity, Moisture content, Pressure head, Saturated flow.

In this study the program UNSAT 1 was used to simulate the drainage of water from a uniform soil on a hillslope so as to investigate the effects of extraction of water from the unsaturated zone. UNSAT 1 uses a Galerkin-type finite-element method to solve the partial differential equation for flow in a saturated-unsaturated porous medium. The results suggest that: (1) The response of the flow system to extractions from the unsaturated zone is fast enough for a diurnal fluctuation in transpiration from the unsaturated zone to cause a diurnal fluctuation in streamflow. (2) A reduction in streamflow caused by a transpiration loss from the unsaturated zone will be much smaller than the transpiration loss. These inferences are tentative because of the following limitations of this study: (1) Material balance errors are of the same order of magnitude as the reductions in seepage outflow. (2) Constant rates of extraction were used. (3) Only one soil type was used. (Humphreys-ISWS)
W80-04620

AN AUTOMATIC ELECTRICAL RESISTANCE SOIL-MOISTURE MEASURING SYSTEM,
Kansas Univ., Lawrence.
T. H. L. Williams.
Journal of Hydrology, Vol 46, No 3/4, p 385-390, April 1980. 3 Fig, 7 Ref.

Descriptors: *Soil moisture meters, *Instrumentation, *Calibrations, Soil moisture, Resistance, Physical properties, Electrical resistance, Electrical properties, Measurement, Gypsum, Gypsum resistance blocks.

The design, calibration, and operation of a reliable yet simple automatic scanning and recording electrical resistance system for the measurement of soil moisture were described. The electrical resistance soil-moisture measuring block utilizes two electrodes separated by some insulating porous material. The material takes up water when placed in contact with the soil until the moisture tension within it equilibrates with the moisture tension in the soil. Subsequent changes in the soil-moisture tension are reflected in variations in the moisture content of the block. The electrical resistance between the electrodes of the block is related to its moisture content and, therefore, a calibration curve of soil moisture vs. block resistance can be constructed. Three types of resistance block are in common use, employing either gypsum, fiberglass, or nylon as the insulating material. The system described was based on the gypsum block but will work equally well with the other types. The system has operated successfully in a field site for two years without problems. The linearity of the calibration curve is retained down to low battery voltages, and the gradient of the curve varied by less than 5% over a period of two years. Measurement accuracy is better than 3%. The system is substantially independent of variations in temperature, the reference resistances having temperature coefficients of 0.05% per degree Celcius. (Humphreys-ISWS)
W80-04622

A STUDY OF STRONTIUM-90 MOVEMENT IN A SANDY SOIL,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service de

Radio-Agronomie.
For primary bibliographic entry see Field 7B.
W80-04637

CHLORIDE DISPLACEMENT BY WATER IN HOMOGENEOUS COLUMNS OF THREE SOILS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
B. S. Ghuman, and S. S. Prihar.
Soil Science Society of America Journal, Vol 44, No 1, p 17-21, January-February 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Leaching, *Soil water movement, *Dispersion, Salts, Chlorides, Infiltration, Soil water, Wetting, Soils, Soil types, Laboratory tests, Equations, Soil moisture, Soil science, Chloride displacement, Convection-diffusion equation.

The comparative effects of soil texture on solute profiles during miscible displacement of noninteracting electrolytes are not available in the literature. The displacement of a surface slug of chloride during infiltration and redistribution of water in columns of loamy sand, sandy loam, and silt loam soils was studied. For air-dry soil, maximum solute concentration occurred at the wetting fronts in sandy loam and silt loam but lagged behind the front in the loamy sand. Nevertheless, the position of the solute front coincided with the wetting front in all three soils. After redistribution, the salt peak for v = 1.0 cm/hour was located several centimeters behind the wetting front in the air-dry loamy sand, but coincided with the wetting front in air-dry sandy loam and silt loam. In initially moist soils the salt peak lagged behind the wetting front in all soils. While the depth of chloride peak was not affected by initial soil wetness (theta sub 1) in sandy loam and silt loam, in the loamy sand the salt peak occurred at shallower depth with theta sub 1 = 0.10 than with theta sub 1 = 0.07 cu cm/cu cm. An analytical solution of the solute transport equation described reasonably well the shape and location of chloride slug immediately after its displacement with a given rate and amount of water. When infiltration and redistribution times were matched, water applied at v = 1.0 cm/hour (or ponding in silt loam) moved the salt deeper than v = 0.1 cm/hour in sandy loam and silt loam soils. But in the loamy sand the reverse was true because the redistribution water after the faster application moved through larger pores without taking along the salt. (Sims-ISWS)
W80-04639

EFFECT OF SIMULATED ACID RAIN ON SULFATE MOVEMENT IN ACID FOREST SOILS,
Norwegian Forest Research Inst.
For primary bibliographic entry see Field 2B.
W80-04640

PLANTING WHEEL TRAFFIC EFFECTS ON INTERROW RUNOFF AND INFILTRATION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
M. J. Lindstrom, and W. B. Voorhees.
Soil Science Society of America Journal, Vol 44, No 1, p 84-88, January-February 1980. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Compaction, *Runoff, *Infiltration, *Farm management, On-site investigations, Simulated rainfall, Porosity, Soils, Soil properties, Erosion, Soil erosion, Erosion control, Agriculture, Tillage systems, Tillage practices, Residue, Random roughness, Rainfall erosion index, Interrow zone, Wheel traffic.

Simulated rainfall trials were conducted in wheel-tracked and nonwheel-tracked interrows for three row crop tillage systems (fall moldboard plow with spring disk and harrow, fall chisel with spring disk and no till) at three locations in the northwestern Corn Belt to determine the effect of wheel traffic from the planting operation on interrow runoff and infiltration. Roughness and total porosity differences were noted between the tillage systems and wheel-track variable. Simulated rainfall was applied with a sprinkling-type infiltrometer at a rate of 12.7 cm/hour simultaneously to wheel-tracked and nonwheel-tracked interrows. Differences in energy, reported as rainfall erosion index (EI), to initiate runoff between tillage systems were observed, but these differences were not uniform between locations. In general, the tilled systems required a higher EI to initiate runoff than the no-till system. In paired comparisons, the nonwheel-tracked interrow required a higher EI to initiate runoff and had a higher infiltration rate during runoff than did the wheel-tracked interrow at all locations on all tillage systems. Results from this study suggested that the frequency of interrow traffic must be considered in the design of tillage systems for water conservation and erosion control. (Sims-ISWS)
W80-04641

NITROGEN AND WATER DISTRIBUTIONS IN FERTILIZED SANDY SOIL DURING IRRIGATION AND DRAINAGE,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, H. M. Selim, D. V. Calvert, E. H. Stewart, and L. H. Allen.
Soil Science Society of America Journal, Vol 44, No 1, p 95-102, January-February 1980. 9 Fig, 2 Tab, 12 Ref. EPA R800517.

Descriptors: *Nutrients, *Drainage, *Subsurface drainage, *Water quality, *Florida, Acidic soils, Sands, Nitrogen, Water pressure, Soil water, Soil water movement, Drains, Linings, Subsurface drains, Fertilizers, Agricultural chemicals, Agriculture, Cultivation, Spodosol.

Nutrients applied to citrus growing in subsurface-drained acid, sandy soils of Florida are subject to movement through the soil and possible loss through drainage water especially after intense rainfall. The primary objective of this investigation was to determine the spatial distributions of soil water pressure head and concentrations of nitrogen (N03-N and NH4-N) in the soil solution after fertilization and irrigation of citrus in a subsurface-drained Spodosol. The soil treatments were: (1) shallow tillage and shallow liming (ST), and (2) deep tillage and deep liming (DTL). Tensiometers and solution sampler cups were placed at several soil depths and lateral distances on either side of a subsurface drain. Results showed transport of water and nutrients in the ST soil was rapid relative to DTL soil. Two-dimensional contours of equal soil-water pressure revealed that, after a 3.4-cm irrigation, slower drainage in DTL soil relative to ST raised the water table near the soil surface (to within 30 cm), of the DTL soil, whereas the water table in the ST soil rose to only about 80 cm from the soil surface. Observed distributions of N03-N and NH4-N concentrations in the soil solution exhibited considerably higher spatial variability than soil water pressure head distributions for both soils. Concentrations of N03-N were always higher than NH4-N in either soil. Rates of drainage were higher for ST than DTL soils. Over a 2-week period, the amount of N03-N in the drainage water from ST soil was four times greater than from DTL soil. It was concluded that N03-N was less susceptible to leaching loss in the DTL soil than in the ST soil. (Sims-ISWS)
W80-04642

2H. Lakes

EFFECTS OF CHANGES IN DRAINAGE-BASIN BOUNDARIES ON SEDIMENTATION IN EOCENE LAKES GOSIUTE AND UINTA OF WYOMING, UTAH, AND COLORADO,
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W80-04541

PHOTOSYNTHESIS AND GROWTH OF SPIRULINA PLATENSIS (CYANOPHYTA) IN AN EQUATORIAL LAKE (LAKE SIMBI, KENYA),
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W80-04647

THE CHEMISTRY OF LAKE MYVATN AND RIVER LAXA,
Marine Research Inst., Reykjavik (Iceland).
For primary bibliographic entry see Field 5C.
W80-04657

LIMNOLOGICAL STUDIES IN MONTANA: HYALITE RESERVOIR AND RESPONSES OF LOTIC PERIPHYTON TO DEEP-WATER DISCHARGES, GRAZING AND LOGGING,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 4C.
W80-04670

NORTHERN LAKE MODELING: A LITERATURE REVIEW,
Alaska Univ., Fairbanks. Inst. of Water Resources.
P. M. Fox, J. D. LaPerriere, and R. F. Carlson.
Water Resources Research, Vol 15, No 5, p 1065-1072, October 1979. 4 Tab, 118 Ref. OWRT C-6169 (No 5217)(2), 14-31-0001-5217.

Descriptors: *Lakes, *Model studies, *Mathematical models, *Reviews, Cold regions, Subarctic, Temperature, Water temperature, Ice, Snow, Water quality, Algae, Zooplankton, Fish, Water chemistry, Publications, Northern lakes.

While there are many diverse temperate lake models available, there are none which are comprehensive annual northern lake models. Northern lakes are those which lie above 40 deg N latitude, have continuous winter ice cover, and experience large seasonal differences in daylight patterns. Therefore, it is necessary to review the temperate ecosystem and smaller process models along with reported field studies to assess model adequacy for northern application. While most northern lake processes have been described in the literature, there is little agreement between investigators as to specific formulations. However, lake modeling can be a viable tool in northern lake utilization studies provided certain precautions are taken. When using the various formulations presented in this review to develop and apply a model, all assumptions of each component should be considered. Also, the uncertainty in the data and model should be incorporated or at least considered with the resulting estimates. (Sims-ISWS)
W80-04677

2I. Water In Plants

THE NORTH MAROONDAH EXPERIMENT PRETREATMENT PHASE COMPARISON OF CATCHMENT WATER BALANCES,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4A.
W80-04512

RADIO-MANGANESE, -IRON, AND -PHOSPHORUS UPTAKE BY WATER HYACINTH AND ECONOMIC IMPLICATIONS,
University of South Florida, Tampa.
T. N. Cooley, M. H. Gonzalez, and D. F. Martin.
Economic Botany, Vol 32, No 4, p 371-378, October-December 1978. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Water hyacinth, *Phosphorus, *Iron, *Manganese, *Plant physiology, *Nutrient removal, Kinetics, Nutrients, Nutrient requirements, Tracers, Root distribution, Leaves, Sewage treatment, Sewage lagoons, Water quality, Economics, Rates, Density, Metabolism.

Manganese, iron and phosphorus are all actively absorbed by water hyacinth (Eichhornia crassipes) root systems; however, rates of absorption and translocation differ markedly. Absorption rates of manganese by roots are considerably greater than values for phosphorus or iron. The rate of manganese uptake in roots is 13 and 21 times that for radio-iron, and -phosphorus, respectively. Iron is

taken up by roots at nearly twice phosphorus rates. Phosphorus and manganese rapidly appear in leaves, whereas iron begins to appear slowly in leaves only during the first 21 days. Translocation of iron is slow (manganese rates are 65 times that for iron), and manganese translocation is faster than that of phosphorus by an order of magnitude. Amounts of elements taken up by water hyacinths are calculated to be 7.80 mg P/plant, 5.73 mg Mn/plant and 0.40 mg Fe/plant for one week for plants with mean weights of 3.5 g dwt. Estimates are also made for the amount of phosphorus that is removed from treated sewage by water hyacinth plants. With 18 plants/sq m density, a typical facility processing 3.8 million l treated sewage requires 8,190 sq m surface area and 0.5 m mean depth. With 1 microg P/ml available phosphorus present, about 71% of the available phosphorus can be removed in two weeks. Water hyacinths with 50 plants/sq m density, remove 209 kg P/ha yr; with 500 plants/sq m, 2,093 kg P/ha yr is removed. Water hyacinth utilization to remove selected trace elements can aid sewage treatment and help prevent polluted lakes and streams. (Danovich-Wisconsin)
W80-04649

DAMS AND WILDLIFE,
Wisconsin Univ.-Eau Claire. Dept. of Biology.
R. E. Lewke.
Passenger Pigeon, Vol 40, No 3, p 429-442, Fall, 1978. 6 Fig, 3 Tab, 9 Ref. OWRT A-054-WASH(4), 14-31-0001-3848.

Descriptors: *Riparian waters, *Dams, *Birds, *Ecological distribution, *Environmental effects, Ecology, Impoundments, Rivers, Post-impoundment, Banks, Wetlands, Reservoirs, Flood plains.

Nearly 100 percent of the Lower Snake River flood plain between Lower Granite Dam and Clarkston, Washington, was inundated in February, 1975. Of the area inundated, 16 percent represented valuable riparian habitat and 84 percent represented weedy flood plain habitat. Evidence indicated that most displaced birds would not be able to re-establish themselves in remaining above-pool habitats, and that the loss of below-pool habitats would indirectly cause a decrease in the number of birds remaining in above-pool habitats. Of the 129 bird species observed in the study area before inundation, 50 percent were found to be significantly dependent upon the riparian physiognomic type. Impoundment was estimated to cause the loss locally of over 14,000 birds in summer and 30,000 in winter. Migrant species of birds, excluding waterfowl, did not utilize the Lower Snake River Canyon habitats to a great degree and thus will not be affected nearly as much as permanent, summer, and winter resident species. Since different species will not be affected equally by habitat loss, population density of each species will decline disproportionately. (Howard-Mass)
W80-04678

2J. Erosion and Sedimentation

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: III. A CONCEPTUAL MODEL FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-04515

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: IV. MODEL INPUTS AND VERIFICATION FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-04516

EFFECTS OF WOOD PRODUCTS HARVEST ON FOREST SOIL AND WATER RELATIONS,
Northeastern Forest Experiment Station, Parsons, WV. Timber and Watershed Lab.
For primary bibliographic entry see Field 4C.
W80-04519

FERTILIZER NUTRIENT LOSSES FROM RANGELAND WATERSHEDS IN CENTRAL OKLAHOMA,
Science and Education Administration, Durant, OK.
For primary bibliographic entry see Field 5B.
W80-04520

COMPUTATION OF BED LOAD USING BATHYMETRIC DATA,
National Water Research Inst., Burlington (Ontario), Hydraulic Research Div.
P. Engel, and Y. L. Lau.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY3, Proceedings Paper 15255, p 369-380, March 1980, 5 Fig, 2 Tab, 16 Ref, 2 Append.

Descriptors: *Bathymetry, *Sediment load, *Bed load, Bed load samplers, Sediment transport, Surveys, Hydraulics, Sedimentation, Sediment discharge, *Bed forms, Bed load movement, Bed load transport.

A method of calculating bed-load transport was presented. This method takes advantage of the rapid bathymetric surveys that can be made in large rivers. The proposed equation is based on sediment continuity and an assumption for the base level of zero transport. Experimental data were obtained in a series of flume tests, and the measured transport rates were compared with the calculated transport rates using the proposed equation. Comparisons were also made with the Ackers-White equation. (Lee-ISWS)
W80-04534

DEBRIS FLOW ON PRISMATIC OPEN CHANNEL,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 2E.
W80-04535

EFFECTS OF CHANGES IN DRAINAGE-BASIN BOUNDARIES ON SEDIMENTATION IN EOCENE LAKES GOSIUTE AND UINTA OF WYOMING, UTAH, AND COLORADO,
Wyoming Univ., Laramie. Dept. of Geology.
R. C. Surdam, and K. O. Stanley.
Geology, Vol 8, No 3, p 135-139, March 1980. 3 Fig, 16 Ref. NFS DES72-01461 A01.

Descriptors: *Sedimentation, *Lakes, *Watersheds(Basins), *Wyoming, *Utah, *Colorado, Geomorphology, Evaporation, Groundwater, Surface waters, Recharge, Stratigraphy, *Lake Gosiute, Lake Uinta.

The regimes of early Tertiary Lakes Gosiute and Uinta were strongly affected by pronounced imbalance between evaporation and recharge by surface and groundwater. Both evaporation and recharge were strongly affected by the climate of the closed hydrographic basins where the lakes formed. However, at unique times in the histories of the Lake Gosiute and the Lake Uinta basins, the regimes of these lakes were significantly modified by enlargement of the drainage basins to include water from basins farther north. Evidence for changes in the size of drainage basins includes southward dispersal of volcaniclastic sands containing basaltic to dacitic volcanic rock fragments from the Absaroka volcanic field in northwestern Wyoming. The southward progradation of the resulting sandstone units from the Wind River Basin into the greater Green River Basin and from there into the northern Piceance Creek Basin records the successive depositional filling of closed hydrographic basins so that water and sediment were transported by streams over the lowest divides into the adjacent basins. Filling of these basins allowed large volumes of surface and groundwater to be added first to Lake Gosiute and then to Lake Uinta. The added water resulted in: (1) a rise in lake level, (2) the development of nutrient-rich lakes where algal productivity led to the deposition of precursors of oil shale, and (3) in the case of Lake Uinta, a change in water chemistry such that brines precipitated sodium carbonate rather than calcium sulfate minerals. Basin filling and enlargement of the drainage systems were probably a consequence of tectonic activity and stability of the basins and adjacent uplifts, although climatic conditions that increased sediment yield and runoff in the hydrographic basins also could have hastened their filling. However, it is difficult to explain patterns of evaporite minerals, oil shale, mudstone, and sandstone formed in Lakes Gosiute and Uinta if climate was the dominant factor. (Humphreys-ISWS)
W80-04541

THE EFFECT OF ALTERED STREAMFLOW ON THE HYDROLOGY AND GEOMORPHOLOGY OF THE YELLOWSTONE RIVER BASIN, MONTANA,
Montana Dept. of Natural Resources and Conservation, Helena.
For primary bibliographic entry see Field 2A.
W80-04542

SEDIMENT DISCHARGE AND CHANNEL CHANGE IN THE NORTH FORK TETON RIVER, 1977-78, FREMONT AND MADISON COUNTIES, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. P. Williams.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO. 80225, paper copy $12.50, microfiche $5.00. Geological Survey open-file report 79-1335, October 1979. 81 p, 7 Fig, 10 Tab, 11 Ref.

Descriptors: *Sediment discharge, *Channel erosion, *River flow, *Idaho, *Geomorphology, Dam failure, Floods, Channel improvement, Natural flow, Sediment transport, Deposition(Sediments), Equilibrium, Bank erosion, Bed load, Hydrologic data, *North Fork Teton River(Idaho), *Teton Dam(Idaho).

The Teton Dam failure flood of June 5, 1976, severely disrupted the geomorphic character of North Fork Teton River in Idaho. Extensive channel restoration was required to contain expected normal spring flows. Six principal sites were established on the 17-mile reach of the river to study sediment transport and channel change during 1977-78. During April 1 to September 30, 1977, total water discharge at Teton Island bridge was 97,530 acre-feet; 4,360 tons of total sediment were transported. Total water discharge, April 1 to September 30, 1978, was 191,940 acre-feet; 10,680 tons of total sediment were transported. Analyses of data indicated several trends of erosion and deposition. Minimal channel change in the upper 7 miles of the river indicated equilibrium may temporarily exist between hydraulic-flow properties and channel shape. Streambed profiles indicated little change in streambed elevations. Erosional tonnage at mid-study reaches was 4,260 tons. One-half mile downstream, an increase of 4,150 tons of suspended and 1,050 tons of bedload sediment probably was partly derived from upstream bank erosion. An estimated 5,870 tons was deposited within the next subreach downstream. Virtually the entire bedload was redeposited before the last subreach, 4.4 miles downstream measured bedload was 91 tons. Suspended-sediment discharge transported past the last site was 16,470 tons. Lateral erosion and deposition in the lower 10 miles of the river indicate that subreaches now shortened by man-made channel alinements may begin to meander. Future deposition of coarse material at upstream gravel and concrete impoundments may trigger instability in the entire river. (Kosco-USGS)
W80-04562

RECENT GRADATIONAL AND CHANNEL-MIGRATION HISTORY OF THE KANSAS RIVER -- A GUIDE FOR FLOODPLAIN MANAGEMENT,
Kansas Water Resources Research Inst., Manhattan.
W. Dort, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174501, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, April 1980, p 80, 7 Fig, 40 Ref. OWRT A-083-KAN(1), 14-34-0001-7035.

Descriptors: *Channel morphology, *Channel erosion, Bank stability, Bank stabilization, Meanders, Flood plains, Kansas, *Kansas River, Bank erosion, Bed erosion, Alluvial channels, River regulation, Meander migration, *Channel migration.

Since 1976, studies of the history of migration of 725 channel miles of the Kansas River and major tributaries have proceeded under contract with the Kansas City District of the U.S. Army Corps of Engineers. An 85-mile reach from Topeka to Kansas City has been investigated for the Kansas Water Resources Research Institute. Both projects are continuing. Historical data on channel shape and position have been acquired from published maps judged sufficiently accurate back into the 1850s. Scattered information about prehistoric courses was obtained by analysis of floodplain scrolls and abandoned channels visible on aerial photographs. The Corps has recently published an atlas of 41 maps that display changes in channel position by use of eleven colors. The 125-year record on the Kansas River reveals a spatial alternation of stable and unstable reaches. Some portions of the channel have moved rapidly across the floodplain in complex patterns; other segments have remained absolutely immobile. Locations of movement with the past ten or so years do not all correlate with sites of earlier movement. Sudden migration has locally erupted in areas stable for the preceding century.
W80-04600

NIPS, NOTCHES, AND THE SOLUTION OF COASTAL LIMESTONE: AN OVERVIEW OF THE PROBLEM WITH EXAMPLES FROM GREECE,
California Univ., Davis. Dept. of Geology.
C. G. Higgins.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 15-30, January 1980. 4 Fig, 2 Tab, 48 Ref. ONR Nonr-2211-02.

Descriptors: *Coasts, *Erosion, *Limestone, *Calcium carbonate, Shores, Dissolved solids, Rocks, Freshwater, Saline water-freshwater interfaces, Sea water, Groundwater, Tides, Water levels, Waves(Water), Oceans, *Greece, Coastal erosion, Nips, Notches.

The origins of intertidal indentations and undercuts (nips and notches) in calcareous shores has long been disputed. In recent years this dispute has centered on the efficacy of solution by seawater vs. the erosional effects of marine organisms. Little attention has been given to solution by fresh groundwater even though it is a proven solvent of calcareous rocks whereas seawater is not. The solutional effects of groundwater--either floating as a surface layer on seawater or seeping through porous rocks at the shoreline--would be strictly confined to the intertidal zone and most intense at midtide level. Just such a distribution of erosional effect is required for the formation of nips and notches, yet such a distribution of effect has yet to be demonstrated either for seawater or for most erosional marine organisms. On purely theoretical grounds, then, solution by groundwater deserves consideration as a major factor in the origin of coastal undercuts. In Greece, notches in calcareous rocks occur only in proximity to coastal springs, where surface seawaters are locally diluted by freshwater. Percent saturation of these waters with respect to calcium carbonate is not known, but the one-to-one correspondence of notches with springs is by itself persuasive circumstantial evidence that solution by groundwater is the chief factor in the origin of the notches. (Sims-ISWS)
W80-04628

CHEMICAL TRACERS FOR PARTICLE TRANSPORT IN THE CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5B.
W80-04632

PLANTING WHEEL TRAFFIC EFFECTS ON INTERROW RUNOFF AND INFILTRATION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 2G.
W80-04641

RECENT SEDIMENTATION HISTORY OF THE WAIMAKARIRI RIVER, NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Div.
G. A. Griffiths.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 6-28, 1979. 10 Fig, 3 Tab, 1 Plate, 25 Ref.

Descriptors: *Sedimentation, *Aggradation, *Gravels, *Degradation(Stream), Rivers, Watersheds(Basins), Erosion, Sediment transport, Meanders, Bank erosion, Mathematical models, Suspended load, Bed load, *New Zealand, Sedimentation history, Kinematic wave model.

The Waimakariri River is one of several large, steep, braided, gravel-bed rivers that rise in the Southern Alps of New Zealand and flow eastwards to the Pacific Ocean. Its upper catchment has a mountainous topography reflecting continuing rapid uplift and extensive glacial and postglacial erosion; in its lower catchment the river is incised into a number of outwash and aggradational surfaces. The transition between downcutting and fan building is currently located about 18 kilometers from the sea. Below the transition, severe aggradation is occurring. Quantitative analysis of river cross-section survey data collected over the past 45 years demonstrates that at least 65% of this aggradational material is derived locally--not from the upper catchment area where the channel is stable. Over the past century the lower catchment channel has been confined over most of its length by regulatory works. There, major changes in sedimentation patterns include the imposition of a broad meander pattern, extensive channel bank erosion, bed degradation and aggradation, and the downstream migration of a gravel tongue. An example was given of a river reach that has translated amounts of gravel far in excess (49 times) of its theoretical bed load transporting capacity while remaining substantially unaltered in width, bed material size, slope, and mean bed level. Much of this gravel is supplied by bank erosion and channel bed degradation; this material moves downstream as channel sediment waves. A mathematical model was presented describing the kinematics of these waves. Long-term, at-a-station, sinusoidal fluctuations in mean bed level on another river were presented as further field evidence for their existence. (Lee-ISWS)
W80-04643

SEDIMENT LOADS OF NORTH ISLAND RIVERS, NEW ZEALAND--A RECONNAISSANCE,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
J. Adams.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 36-48, 1979. 2 Fig, 2 Tab, 25 Ref.

Descriptors: *Suspended load, *Bed load, *Dissolved solids, Watersheds(Basins), Rivers, Sediment transport, Suspended solids, Sediment load, Flow, Sediment yield, Erosion, Erosion rates, River flow, River basins, *Dissolved load, *New Zealand.

Suspended load, dissolved load, and bed load (for 23 catchments only) were calculated by approximate methods for 40 rivers in the North Island. The proportion of each type of load was roughly 88%, 10%, and 2%, but the dissolved load was relatively more important in rivers draining catchments with slight erosion and the bed load more important in rivers draining directly from the eastern mountain ranges. The river catchments, mostly 150 to 1500 sq km in area, had suspended sediment yields ranging from 35 t/sq km/yr to 28,000 t/sq km/yr with the highest yields being from catchments in the East Cape region. (Lee-ISWS)
W80-04644

2K. Chemical Processes

PRECIPITATION ACIDITY: THE ROLE OF THE FOREST CANOPY IN ACID EXCHANGE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
W. A. Hoffman, Jr., S. E. Lindberg, and R. R. Turner.
Journal of Environmental Quality, Vol 9, No 1, p 95-100, January-March 1980. 3 Fig, 2 Tab, 35 Ref. DOE W-7405-eng-26.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Forests, Trees, Oak trees, Leaves, Vegetation effects, Acids, Sulfates, Nitrates, Organic compounds, Hydrogen ion concentration, Sampling, Chemical analysis, Rain, Air pollution, Path of pollutants, Water pollution, Water chemistry, Acid precipitation.

Individual rain events were sampled above and below the forest canopy in Walker Branch Watershed, Tennessee, from August 1977 to June 1978 for the purpose of analysis of acidity and organic content. Strong acid content correlated with sulfate concentrations. Total acid concentrations were conserved as rain penetrated chestnut oak (Quercus prinus L.) canopies, although the strong/weak acid ratio decline substantially. Although weak acids constituted at least 30% of the total acidity of incident rain and increased to over 50% in throughfall, the increase could not be entirely attributed to organic acids. The results of the study support the fundamental importance of ion-exchange models in systematizing rain-vegetation interactions. (Sims-ISWS)
W80-04521

CALCULATION OF THE IN SITU PH OF SEAWATER,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2L.
W80-04533

GROUNDWATER CHARACTERISTICS AND CORROSION PROBLEMS ASSOCIATED WITH THE USE OF GEOTHERMAL WATER IN KLAMATH FALLS, OREGON,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8G.
W80-04763

PREDICTED CORROSION AND SCALE-FORMATION PROPERTIES OF GEOPRESSURED GEOTHERMAL WATERS FROM THE NORTHERN GULF OF MEXICO BASIN,
Y. K. Kharaka, M. S. Lico, and W. W. Carothers.
Journal of Petroleum Technology, Vol 32, No 2, p 319-324, February, 1980. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Geothermal studies, *Corrosion, *Scaling, Chemical analysis, Gulf of Mexico, Chemical precipitation, Equations, Water chemistry, Chemical reactions.

This paper describes chemical and physical parameters of selected geopressured geothermal water that indicate their potential for corrosion and scaling. Detailed chemical analyses of 120 water samples from depths of 1,000 to 5,600 m show that the salinity of water in the geopressured zones ranges from 10,000 to 270,000 mg/l dissolved solids. Na and Cl generally constitute more than 90% of the total cations and anions, respectively. Corrosion and scale-formation properties of geopressured geothermal water are different from those of waters with similar chemical composition but produced from oil and gas wells. This is due to higher temperatures and withdrawal rates and the absence of oil in geopressured geothermal waters. The high salinity, Cl concentration and temperature increase the corrosivity by facilitating dissolution of iron at

anodic sites. The corrosivity will be controlled by reactions at cathodic sites which are slow due to the almost complete absence of dissolved oxygen, absence of sulfate-reducing bacteria, and low activity of H+. Hydrogen Sulfide corrosion will be minimal because the concentrations of H2S are less than 1 mg/l. Scale formation from precipitation of carbonates of Ca, Sr, and Ba, sulfate of Ba, and oxyhydroxides of iron is likely during production. (Purdin-NWWA)
W80-04766

2L. Estuaries

THE ESTUARY REVISITED,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, and D. J. Hirschberg.
Water Spectrum, Vol 12, No 2, p 1-9, Spring 1980. 10 Fig.

Descriptors: *Estuaries, *Evolution, *Geologic history, *Speciation, Estuarine environment, Estuarine fisheries, Brackish water, Shellfish, Chesapeake Bay, Fjords, Glaciers, Commercial fishing, Fish harvest, Ecosystems, Sedimentation, Saline water-freshwater interfaces.

An intensive literature review was used to assess estuaries which are semi-enclosed coastal bodies of water that are freely connected to the open ocean and are measurably diluted by freshwater from runoff. A range of geological processes form estuaries such as bar-built estuaries, tectonically formed estuaries, fjord estuaries, and submerged river valley estuaries. Estuaries have not persisted throughout geologic time but are formed or destroyed with changes in ocean water level resulting from the advance or retreat of glaciers. All modern estuaries are geologically very young, approximately 10,000 years, and were formed when the present Holocene Interglacial period began. Estuaries have short geologic life spans measurable in thousands or tens of thousands of years. Estuaries are not vital to the survival of species which inhabit them. During past glacial periods when estuaries were rare or absent these organisms must have lived in open, shallow, brackish areas. Also, there is no evidence that estuaries have played a major role in the evolution of marine species. Estuaries are, however, important as fisheries since without them the finfishes and shellfishes harvested by man would not exist in sufficient number for harvesting. Man is the most estuarine-dependent organism, he makes the most demands, and is the only organism capable of managing estuaries to produce their longest biologically and recreationally useful life. (Seigler-IPA)
W80-04505

MIXING PROCESSES ON THE ATLANTIC CONTINENTAL SHELF, CAPE COD TO CAPE HATTERAS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-04532

CALCULATION OF THE IN SITU PH OF SEAWATER,
Delaware Univ., Newark. Coll. of Marine Studies.
C. H. Culberson.
Limnology and Oceanography, Vol 25, No 1, p 150-152, January 1980. 3 Tab, 11 Ref. NSF OCE78-07488.

Descriptors: *Hydrogen ion concentration, *Sea water, *Model studies, Mathematical models, Equations, Oceans, Carbon dioxide, Water temperature, Pressure, Alkalinity, Salinity, Water chemistry, Oceanography.

The in situ pH at oceanic temperatures and pressures was calculated from the exact solution to the cubic equation relating total inorganic carbon dioxide to total alkalinity. The method does not require iteration. The equations for calculating pH from the partial pressure of carbon dioxide and the total alkalinity were also given. (Sims-ISWS)
W80-04533

MAINE COASTAL STORM AND FLOOD OF FEBRUARY 2, 1976,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-04553

LONGSHORE PRESSURE GRADIENTS CAUSED BY OFFSHORE WIND,
Woods Hole Oceanographic Institution, MA.
G. T. Csanady.
Journal of Geophysical Research, Vol 85, No C2, p 1076-1084, February 20, 1980. 8 Fig, 13 Ref, 1 Append.

Descriptors: *Winds, *Currents(Water), *Ocean circulation, Tidal waters, Pressure head, Oceanography, Beaches, Coasts, Friction, Flow, Mathematical models, Model studies, Vortices, Ocean currents, Analytical techniques, On-site data investigations, Theoretical analysis, *Offshore wind, Pressure gradients, Longshore nontidal flow, Ekman drift, Longshore flows.

Observations of currents 12 km south of the Long Island coast show that strong offshore winds could generate considerable longshore nontidal flow well below any surface Ekman drift. A momentum balance calculation in the longshore direction shows a surface level gradient of order 0.000001 to be the proximate cause of the longshore flow. A very simple model of the observed phenomena is a sloping plane beach acted upon by cross-shore wind, varying sinusoidally in the longshore direction. With bottom friction parameterized by a linear law, a parabolic equation is found to govern steady state flow, expressing a balance of vorticity tendencies due to cross-isobath flow, curl of bottom stress, and any forcing. Calculated solutions for variable cross-shore wind show a trapped pressure field on the inner shelf which controls the transition between an essentially frictionless momentum balance on the outer shelf to frictionally dominated flow at the shore. Realistic estimates of the parameters entering the theory suggest that the longshore gradients associated with the trapped inner shelf field are of the correct order of magnitude to explain the generation of longshore flow by a system of cross-shore winds. (Lee-ISWS)
W80-04626

BENTHIC INFAUNAL VARIABILITY ON A TRANSECT IN THE GULF OF MEXICO,
Texas Univ. at Austin, Port Aransas. Marine Science Inst.
R. W. Flint, and J. S. Holland.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 1-14, January 1980. 5 Fig, 4 Tab, 34 Ref. BLM AA550-CT6-17.

Descriptors: *Benthic fauna, *Coasts, *Gulf of Mexico, *Texas, Benthos, Biological communities, Marine biology, Continental shelf, Sediments, Sampling, Variability, Temperature, Water temperature, Salinity, Depth, Biology.

Macroinfaunal benthos off the South Texas Coast of the Gulf of Mexico formed different assemblages distributed according to depth: shallow (22 m), mid-depth (36 to 49 m), and deep water (78 to 131 m). Species composition of shallower stations were less diverse, composed of eurytopic and opportunistic species adapted to a fluctuating environment. The deep water benthos, in a more stable environment, had a higher diversity. Sediment composition (high proportions of silt) at the mid-depth stations resulted in dominance of deposit feeders. The environmental gradient was related to a species continuum which changed from polychaete dominated groups in shallow water, to deposit feeding molluscs and crustaceans, to a deep water diverse fauna not dominated by any particular group. Environmental heterogeneity, including climatic variability, may be most important in controlling shallow water benthos. In deeper more stable shelf habitats where diversities are higher and species equilibrium is the case, species interactions may determine community structure. (Sims-ISWS)
W80-04627

NIPS, NOTCHES, AND THE SOLUTION OF COASTAL LIMESTONE: AN OVERVIEW OF THE PROBLEM WITH EXAMPLES FROM GREECE,
California Univ., Davis. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W80-04628

RECURRING AGGREGATION OF ZOOPLANKTON BY A TIDAL CURRENT,
California Univ., Santa Barbara. Dept. of Biological Sciences.
A. L. Alldredge, and W. M. Hamner.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 31-37, January 1980. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Zooplankton, *Distribution patterns, *Spatial distribution, *Currents(Water), *Australia, Coasts, Shores, Tides, Tidal waters, Tidal effects, Circulation, Water circulation, Velocity, Fish, Benthic fauna, Marine biology, Aggregation.

Zooplankton densities up to 40 times greater than those in adjacent water accumulated in the lee of a small point protruding into a strong tidal current at Whitsunday Island, Queensland, Australia. The density of plankton in the lee was linearly correlated with current velocity past the point, reaching maximum concentrations at mid-flood tide and decreasing as slack tide approached. Zooplankton did not accumulate when tidal flow reversed direction. Possible mechanisms of aggregation were discussed. Mass transport of zooplankton into lees by fine-scale current patterns may be a major cause of plankton aggregation in some near-shore localities and may significantly affect the distribution of fish and benthic invertebrates. (Sims-ISWS)
W80-04629

A ONE-DIMENSIONAL REPRESENTATION OF RESIDUAL CURRENTS IN THE SEVERN ESTUARY AND ASSOCIATED OBSERVATIONS,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles, and M. B. Jordan.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 39-60, January 1980. 9 Fig, 1 Tab, 22 Ref.

Descriptors: *Estuaries, *Tides, *Water circulation, *Water balance, *Model studies, Mathematical models, On-site investigations, Measurement, Water levels, Circulation, Currents(Water), Energy, Energy budget, Tidal waters, Coasts, *Severn Estuary(England), *England.

A one-dimensional hydrodynamical model was used to describe the cross-sectionally averaged Stokes drift and Eulerian residual (tidally averaged) currents in a section of the Severn Estuary between Porthcawl and Sharpness. Residual variables were computed for periodic M sub 2 tides, and as functions of time during simulated spring-neap cycles. The results for periodic M sub 2 tides showed that the landward directed Stokes drift has a spatially averaged value of 3.5 cm/s in the Severn Estuary, which, in the absence of freshwater inputs and meteorological perturbations, is balanced by seaward flowing Eulerian residual currents. The residual setup of water (i.e., the mean surface elevation relative to the value at the seaward boundary) is mainly determined by the magnitudes of the axial density gradients and friction, with the friction dominating for typical salinity distributions; the landward flow of water due to the Stokes drift contributes to the setup, which drives the seaward residual currents against the opposing frictional forces. It was shown that the magnitude of the Stokes drift is mainly determined by the estuary's geometry, the strength of the tidal streams, and the friction (regardless of whether a quadratic or linearized friction law is assumed), the effects of density gradients and axial momentum advection and dispersion being negligible. The computed values of the Stokes drift were compared with observations at nine anchor stations and covering 28 tidal cycles; the agreement between observations and theory was generally good. (Sims-ISWS)

W80-04630

CHEMICAL TRACERS FOR PARTICLE TRANSPORT IN THE CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5B.
W80-04632

SHORT-TERM VARIATIONS IN PHYTOPLANKTON BIOMASS IN A TIDAL ESTUARY IN NORTHERN BRITTANY,
Station Biologique de Roscoff (France).
C. Riaux, and J-L. Douville.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 85-92, January 1980. 4 Fig, 4 Tab, 22 Ref.

Descriptors: *Phytoplankton, *Variability, *Estuaries, *Tidal waters, Chlorophyll, Salinity, Water temperature, Water levels, Biomass, Plankton, Tides, Tidal effects, Hydrodynamics, Sampling, Model studies, Mathematical models, *Penze Estuary(France).

Seasonal and short term variations in phytoplankton biomass were examined in the Penze estuary (Northern Brittany) from June 1975 to July 1976. A simple model was proposed to characterize the seasonal variation of chlorophyll a concentration from June 1975 to June 1976. The tidal cycle seems to induce diurnal variations which may be very important in summer in the upper part of the river. Chlorophyll a concentration increases towards low tide and correlates with salinity and water level. (Sims-ISWS)
W80-04633

LONG-PERIOD GRAVITY WAVES IN ICE-COVERED SEA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-04634

WAVE SETUP OF HARBOR WATER LEVELS,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
R. O. R. Y. Thompson, and B. V. Hamon.
Journal of Geophysical Research, Vol 85, No C2, p 1151-1152, February 20, 1980. 1 Ref.

Descriptors: *Waves(Water), *Harbors, *Water levels, Oceanography, Sea level, Estuaries, Oceans, Gages, Mathematical models, Theoretical analysis, *Wave setup, Radiation stress, Surface waves.

Radiation stress by incoming sea surface waves or swell can raise the mean level of water in a harbor by an amount independent of the size of the harbor. This setup can be a significant confounding factor in determining sea level changes if the sea level gage is inside a harbor with a moderately shallow entrance. The mechanism is independent of 'inverse barometer' or wind setup effects, though it is likely to enhance them. (Lee-ISWS)
W80-04638

THE EFFECT OF SEWAGE EFFLUENT ON THE STRUCTURE AND FUNCTION OF A FRESHWATER TIDAL MARSH ECOSYSTEM,
Rider Coll., Trenton, NJ. Dept. of Biology.
For primary bibliographic entry see Field 5D.
W80-04674

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALTING: AN OFFER YOU MAY NOT REFUSE,
Office of Water Research and Technology, Washington, DC.
W. H. McCoy.
Water Spectrum, Vol 12, No 2, p 48-53, Spring 1980. 8 Fig.

Descriptors: *Desalination processes, *Distillation, *Electrodialysis, *Flash freezing, *Ion exchange, *Reverse osmosis, Membrane processes, Flash distillation, Water purification, Freshwater, Saline water, Salinity, Brines, Desalination, Water sources.

As the Earth's freshwater supply continues to shrink on a per capita basis due to population growth and pollution, interest in the desalting of water grows. By the year 2000 the market for desalting in the U.S. is expected to be over 29 billion gallons per day. Distillation, freezing, reverse osmosis, and electrodialysis are currently used methods of desalting. Factors influencing the effectiveness of each process include plant location, energy and its availability, feedwater type, and available brine disposal methods. Freezing and distillation are the preferred methods for desalting water with a high salt concentration. Multi-stage flash distillation, which is commonly used, has a continuous cycle to make maximum use of energy but problems occur due to scaling and fouling. Three major steps are involved in desalting by freezing: partial freezing to form an ice-slurry, separation of ice crystals from brine, and melting the ice. Freezing cannot currently desalt large quantities on an economical basis. Electrodialysis uses a cell pair with different types of ion-selective membranes and a direct current to cause ion migration. In reverse osmosis, also a membrane desalting process, pressure is applied to the salt water side of a semipermeable membrane causing fresh water to flow through the membrane. All of the processes generate brine wastes that are disposed of in a variety of ways. (Seigler-IPA)
W80-04509

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
For primary bibliographic entry see Field 6E.
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04593

THE EFFECT OF WATER PRETREATMENT CHEMICALS ON THE PERFORMANCE AND DURABILITY OF REVERSE OSMOSIS MEMBRANES,
California Univ., Los Angeles. School of Engineering and Applied Science.
J. W. McCutchan, and J. Glater.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174311, Price codes: A05 in paper copy, A01 in microfiche. Final Report to, Office of Water Research and Technology, January 31, 1980. p 68, 26 Fig, 7 Tab, 45 Ref. OWRT R-0049 (No 7810), 14-30-0001-7810.

Descriptors: *Reverse osmosis, *Membrane processes, *Membranes, *Water treatment, Cellulose acetate type membranes, Polyamide type membranes, Water pretreatment chemicals, Ozone, Chlorine, Bromine, Iodine, Chlorine dioxide, Water flux, Salt rejection, *Membrane damage, *Chemicals, Hydrogen ion concentration.

The sensitivity of commercial reverse osmosis membranes has been studied in a variety of chemical environments. Membranes were supplied by five manufacturers representing three general types. These are cellulose acetate, thin film composite polyamide and homogeneous polyamide. Pretreatment chemicals consisted of halogens, ozone, and chlorine dioxide. Membrane exposure was conducted by soak tests in buffer solutions over a pH range of 3.0 to 8.6 and concentrations between 1.0 and 125 ppm. Assessment of membrane damage was carried out by performance testing in a flat plate laboratory reverse osmosis unit using 5000 ppm sodium chloride feed solution. Chemical attack on membrane polymer was indicated by an increase in water flux and a decrease in salt rejection. Cellulose acetate membranes were the most resistant to chemical attack. They responded only to ozone and were also hydrolized at low pH. Polyamide membranes were sensitive to ozone, halogens, and chlorine dioxide. They were also hydrolized but at low pH. The activity of all chemical agents tested was responsive to solution pH. This factor controls the distribution of halogen molecular and ionic species and consequently the rate and possibly the mechanism of membrane attack. Under conditions which maximize damage, the order of activity of chemicals under study were $O_3 > ClO_2 > Cl_2 > Br_2 > I_2$.
W80-04596

3B. Water Yield Improvement

WEATHER MODIFICATION: WINNERS AND LOSERS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Water Spectrum, Vol 12, No 2, p 28-39, Spring 1980. 10 Fig, 2 Tab.

Descriptors: *Weather modification, *Cloud seeding, *Precipitation(Atmospheric), Agroclimatology, Legal aspects, Political aspects, Rain, Water shortage, Weather patterns, Cost-benefit theory, Rainfall intensity, Environmental effects, Agricultural engineering.

Weather modification in the United States is surrounded by considerable scientific uncertainty and local controversy. In the past the major concern was 'can we do it' with the assumption that weather modification would be for mankind's good. Now, however, the socio-politico-economic-environmental aspects of weather modification are asserting themselves. In the 1960's, situations developed where some people believed that weather modification was hurting their real or perceived interests. Although there is little evidence the weather modification actually decreased rainfall in some areas or caused flooding in others, there was much publicity and much of the general public has become skeptical about the use of weather modification. Questions are voiced concerning the effect of increased snowfall in the mountains on elk herds, the long-term effect of silver iodide on the environment, and the actual economic value of weather modification. Scenarios developed to forecast economic values vary widely, bringing more doubt into the issue. Legally, weather modification operators in the United States are subject to the rules and procedures of tort law and it is likely that the absolute liability (risk-spreading) theory will apply although only about a dozen damage actions have been brought. Weather modification will have to proceed in a comprehensive framework involving everyone potentially affected. (Seigler-IPA)
W80-04508

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
For primary bibliographic entry see Field 6E.
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04593

JOJOBA: AN ALTERNATIVE TO THE CONFLICT BETWEEN AGRICULTURAL AND MUNICIPAL GROUND WATER REQUIREMENTS IN THE TUCSON AREA, ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 3F.
W80-04667

3C. Use Of Water Of Impaired Quality

HYDROLOGIC FEASIBILITY OF UTILIZING PALMS FOR WATER MANAGEMENT IN SOUTHERN NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
R. O. Patt, and D. E. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170624, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1978. 26 p, 6 Fig, 5 Tab, 9 Ref. OWRT A-073-NEV(1), 14-31-0001-6029.

Descriptors: *Dates, *Water management(Applied), *Irrigation water, *Water table, Southwest U.S., Nevada, Arid lands, Crop production, Alkaline soils, Sewage effluents, Alfalfa, Climatology, Palms.

The feasibility of utilizing date and ornamental palms as a management tool for beneficial use of groundwater and waste water in water-short areas such as the southwestern United States was investigated. Three potential planting sites in southern Nevada, the Las Vegas, Pahrump, and Moapa Valleys, were studied. Local climatic conditions in these areas were determined to be suitable for palm propagation. Date culture requires long, hot summers, moderate winters, and low precipitation and humidity from July 1 to September 1, the rapid fruit growth period. Palms readily adapt to various soils and will endure saline soil once established. For the three sites studied the only limiting factors found appear to be the availability and source of water supply. The Las Vegas Valley appears to be the most favorable site studied since it is underlain by shallow groundwater, and irrigation from sewage effluent is available. The Las Vegas Valley would also be an ideal area to study hydrologic characteristics of the palm and water table conditions. Alfalfa is currently the main crop in the valley but problems are occurring due to the high water table and poor irrigation water quality. Date palms would be an economically feasible transition crop for the area and could help to stabilize the water table. (Seigler-IPA)
W80-04504

3D. Conservation In Domestic and Municipal Use

STATE AGENCY EFFORTS IN WATER CONSERVATION.
California State Dept. of Water Resources, Sacramento. Div. of Planning.
Memorandum Report, December 1978. 26 p, 3 Fig, 47 Ref, 4 Attachments.

Descriptors: *Water conservation, *Water consumption, *Water management(Applied), *Water policy, *California, Conservation, Water use, Water resources, Water shortage, Regulation, Water demand, Education.

This report examines a State of California program to implement water conservation measures for all state agencies. Sixty-two state agencies met to decide on how the program should be carried out, and all agreed to set up employee education programs, cut down their own direct water use, convey to the community the need and methods for water conservation, and to have regulatory agencies include water conservation in their regulations where possible. Methods of saving water within state agencies included making maximum use of reclaimed water where available, equipping state-owned dwelling units with water-saving shower and toilet devices, reducing 'open hours' for state park shower facilities, reducing water pressure, adopting emergency water conservation and protection measures for certain state managed watersheds, requiring water permittees and applicants to demonstrate evidence of water conservation action, and preparing draft regulations to prevent waste or unreasonable use of water. Some results of the program include the water conservation education of 129,000 state employees, exposure of 5 million citizens to water conservation publications, and the savings of 30,000 acre-feet of water in state facilities in 1977. (Arnold-NC)
W80-04747

A PILOT WATER CONSERVATION PROGRAM.
California Dept. of Water Resources, Sacramento.
Bulletin 191, October 1978. 64 p, 20 Fig, 3 Tab, 8 Append.

Descriptors: *Water conservation, *Water saving devices, *Water law, *California, *Water use, *Water management(Applied), Water supply, Conservation, Water resources, Water shortage, Water demand, Education, Water pressure, Water control, Water distribution.

This is a report on a program undertaken after the 1976-77 drought to effect water conservation in homes by introducing water saving devices. The goals of the program were to find out if a significant amount of water and energy could be saved by installing water saving devices in dwellings; to determine which methods of distribution are most successful and cost effective; to evaluate relative merits of selling devices or offering them free, and which devices are most acceptable; and to determine the feasibility of distributing water saving devices throughout the state. Six areas were chosen for pilot projects. Number of households varied from 253 to 370,000, water supply conditions varied from no problem to heavy rationing, and home water conservation kit delivery varied from free door-to-door delivery to purchase upon request. In almost all areas, water savings in homes using the kits was significant, most residents had already heard of the program, and there was little or no correlation between income level and willingness to use the kit. Most people believed they were saving water, and overwhelming majorities in each area believed the devices they installed were working. Annual water savings ranged from 12.5 to 3000 acre feet for the various programs. Toilet dams were found to be the most popular tank devices, and the most successful in saving water. Short intensive distribution of devices was most effective; a telephone hotline was found to be essential for giving information on the program. School education programs proved to be important. Interagency cooperation allowed easier access to urban residents, particularly through use of members of the California Conservation Corps taking the water saving kits directly to the public. Devices should be supplied free of charge. (Arnold-NC)
W80-04749

WATER CONSERVATION IN CALIFORNIA.
California Dept. of Water Resources, Sacramento.
Bulletin No 198, May 1976. 95 p, 18 Fig, 29 Tab, 18 Ref, 2 Append.

Descriptors: *Water conservation, *Water policy, *Water law, *California, *Conservation, *Water demand, *Water use, Agriculture, Water resources, Water shortage, Water demand, Water delivery, Hydrologic areas, Regulation, Legal aspects.

This study outlines existing water conservation efforts in the private and public sectors of the economy of the State of California. Following a series of droughts in 1974, 1975, and 1976, the State Department of Water Resources found that water use indicated an 84.69% consumption by agriculture; 13.47% by urban uses; 0.10% for power plant cooling; and 1.74% for fish, wildlife, and recreation. Efforts to persuade the urban sector to save included publishing pamphlets on repair of faulty faucets and plumbing fixtures; reducing exterior residential water use such as lawn watering; installing water saving technology in newly built structures; and installing water-saving devices in existing structures. Examining the state's eleven hydrologic study areas revealed that water shortage problems were exacerbated by economic and development pressures, and thus appropriate land regulatory devices were proposed for those study areas. Possible water savings by the agricultural sector in the eleven study areas ranged 40,000 to 520,000 acre-feet. Major conservation practices in the areas included improved delivery and reuse systems, moratoria on further water extraction, and conjunctive surface-ground operations. For urban water conservation, DWR recommends that all new homes have low-flow device plumbing fixtures; institution of delivery system leak detection programs; and replacing current pricing systems favoring large users with uniform, peak/seasonal or increasing block rates, using the lifeline rate concept where appropriate. Agricultural water conservation measures are also recommended. (Arnold-NC)
W80-04750

3F. Conservation In Agriculture

JOJOBA: AN ALTERNATIVE TO THE CONFLICT BETWEEN AGRICULTURAL AND MUNICIPAL GROUND WATER REQUIREMENTS IN THE TUCSON AREA, ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
K. E. Foster, and N. G. Wright.
Ground Water, Vol 18, No 1, p 31-36, January-February, 1980. 1 Fig, 6 Tab, 16 Ref.

Descriptors: *Arid lands, *Oilseed crops, *Ground water, *Water requirement, Irrigation water, Municipal water, Reasonable use, Water consumption, Overdraft, Arizona, Ground water mining, Water rights, Water law, Ground water basins, Economic feasibility, Acreage.

Municipal, agricultural, mineral and industrial ground water withdrawals from two basins in the Tucson area amount to 376,000 acre-feet per year (AFY) or 296,000 AFY more than the safe yield. About 80 percent of this overdraft is for irrigation agriculture. To insure adequate ground water supplies, the City of Tucson has been purchasing and retiring farmlands in one basin. This creates weed problems for farmers owning adjacent land. An alternative to retiring farmlands and heavy irrigation is to cultivate arid-adapted vegetation with economic potential such as Jojoba. It requires only 1.5 AFY per acre compared with traditional crops that average 4 AFY or more, but it needs 10 years of cultivating before it can produce economically feasible yield. If the City of Tucson subsidized farmers during this time at a rate of $40 per acre, it would save more than 50 percent of the cost to purchase and retire farmlands and still be able to draw water from the basin for municipal uses. However, implementing this plan would require changing Arizona ground water law to allow basin exports without the necessity of land aquisition. (Purdin-NWWA)
W80-04667

WATER, WASTE AND QUALITY MANAGEMENT DURING PREPARATION AND PROCESSING OF VEGETABLES,
Arkansas Water Resources Research Center, Fayetteville.
W. A. Sistrunk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176969, Price codes: A05 in paper copy, A01 in microfiche. AWRRC Publication No 65, August 1979. 107 p, 6 Fig, 72 Tab, 37 Ref, 4 Append. OWRT A-032-ARK(1).

Descriptors: *Vegetable crops, *Waste water(Pollution), *Consumptive use, Efficiencies, Water requirements, Potatoes, Beans, Crops, Fermentation, Sweet potatoes, Agriculture, Industrial wastes, Anaerobic condition, Biochemical oxygen demand, Water quality.

Effluent from vegetable processing plants in the Ozark region was monitored to test and develop new systems of washing, peeling and blanching; to develop methods for utilization of solid wastes; and to reduce effluent wastestrength without affecting vegetable quality. From a processing plants' survey the following operation or factors were found to be the most critical: (1) washing and cleaning, (2) blanching and cooling, (3) high wastestrength from Irish potatoes, dry beans, and

hominy processing, (4) suspended solids removal, and (5) excessive fresh water use. Various processing techniques were tested and waste water was sampled for biochemical oxygen demand, chemical oxygen demand, total suspended solids, settleable solids, and total solids. Vegetable processing methodologies tested included repetitive washing of spinach in the same water to cut down on consumption, steam blanching instead of water blanching, reduced soaking time for dry beans to reduce high wastestrength, and a new hominy preparation method to reduce pollution. The new system of leafy greens washing cut water use by 70% while reducing wastestrength by 50%. Extensive tables of results are given. Results from experiments of the storage and fermentation of high alkalinity wastes from Irish and sweet potatoes are also described. (Seigler-IPA)
W80-04671

WATER CONSERVATION IN CALIFORNIA.
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W80-04750

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE NORTH MAROONDAH EXPERIMENT PRETREATMENT PHASE COMPARISON OF CATCHMENT WATER BALANCES,
Melbourne and Metropolitan Board of Works (Australia).
K. J. Langford, R. J. Moran, and P. J. O'Shaughnessy.
Journal of Hydrology, Vol 46, No 1/2, p 123-145, March 1980. 6 Fig, 6 Tab, 19 Ref.

Descriptors: *Australia, *Watersheds(Basins), *Water balance, *Vegetation regrowth, *Ash trees, Streamflow, Statistical methods, Regression analysis, Water supply, Forest management, Rainfall, Topography, Drainage density, Mountain ash, Basal area, Radiation index, Wetted area.

The North Maroondah Experimental Area contains a series of controlled catchment experiments which have the two major objectives of investigating the effects on long-term streamflow yields of reducing the density of existing 1939 regrowth mountain ash (Eucalyptus regnans), and controlling the density of planting or sowing at the time of establishment of new stands. The aims of the analysis described in this paper are to examine the relationships between catchment water balances and catchment characteristics for the pretreatment period, and to identify any atypical catchments. An intercatchment comparison of twelve regrowth catchments based on an analysis of covariance of annual streamflow and catchment loss (i.e., catchment rainfall minus streamflow) identified two catchments which are losing water, and one collecting water from outside its topographic boundaries. Further statistical analyses of data from the nine typical regrowth catchments detected significant relationships between average catchment loss, radiation index, and basal area of regrowth forest on the catchment. Catchment loss increased with both radiation index and basal area. The results indicated that if a thinned forest behaves in the same way as a natural forest with low basal area increases in streamflow resulting from thinning would be important from a water supply point of view. A comparison of the nine typical regrowth and two old growth catchments showed that the old growth catchments had significantly lower catchment loss. Further analysis showed that there was a significant relationship between annual catchment loss and stocking rate of trees for the eleven catchments. The decrease in streamflow which would result from conversion of an open old growth forest (20 trees/ha) to a dense regrowth forest (400 trees/ha) is of the order of 100-200 mm which is also important from a water supply point of view. (Visocky-ISWS)
W80-04512

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
For primary bibliographic entry see Field 6E.
W80-04573

EFFECTS OF WETLANDS ON WATER QUALITY IN THE DEVILS LAKE BASIN, NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
J. J. Peterka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175292, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University. Research Project Technical Completion Report, October 1979. p 17, 3 Fig, 1 Tab, 4 Ref. OWRT A-052-NDAK(1).

Descriptors: *North Dakota, *Wetlands, *Runoff, *Phosphorus, *Nitrogen, Drainage water, Watersheds(Basins), Agricultural runoff, Nutrients, Water quality, Dissolved solids, Soil properties, Surface runoff, Grassed waterways, Watershed management.

Contributions of dissolved and particulate substances to the runoff from drained wetlands and agricultural lands were studied in the Starkweather Watershed of the Devils Lake Basin, North Dakota. The Starkweather coulee is the major drainage for the 997 sq km Starkweather Watershed. While various sites were used the primary site chosen for sampling was in a 0.50 ha Type IV wetland that normally contains water throughout the year. Although measurements were taken from 1976 through 1979, weather conditions such as drought made runoff sampling difficult. Various factors assessed include: changes in concentrations of substances in runoff with time following drainage, changes in soil nitrogen and phosphorus with time following drainage, trends in concentrations of dissolved and particulate substances both upstream and downstream, and measurements of major anions, cations, seston, conductivity, and pH. Only the results for phosphorus and nitrogen are given; other results are given by De Groot (1979). Results show that the greatest release of nitrogen and phosphorus from drained wetland basins occurs in about the first four years after drainage. High levels of nitrogen in runoff waters from areas of intensive agricultural practice were found in contrast to low levels of nitrogen in grassland runoff areas. These results support the theory that once perennial vegetation is established in a drained wetland only small losses of nitrogen occur unless excessive grazing is permitted. (Seigler-IPA)
W80-04607

NUTRITIONAL COMPOSITION OF WATER HYACINTHS GROWN ON DOMESTIC SEWAGE,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Economic Botany, Vol 32, No 4, p 363-370, October-December 1978. 1 Fig, 9 Tab, 24 Ref.

Descriptors: *Aquatic weed control, *Water hyacinth, *Waste water disposal, *Beneficial use, Aquatic weeds, Nutrients, Eichornia crassipes, Proteins, Feeds, Feed lots, Adsorption, Absorption, Foods, Plant tissues, Fibers(Plant), Waste water treatment.

A nutrient analysis of water hyacinths grown in sewage wastewater was conducted. Plants (Eichornia crassipes) from different sampling locations were found to contain fairly constant amounts of fat, fiber, and ash. However, phosphorus content and crude protein varied considerably among the sampling sites. Direct correlation was found between nutrient loading rate and crude protein content of the water hyacinths. At the highest nutrient loading rates, the difference in percent crude protein was less pronounced, indicating that plant protein reached a maximum level. Most of the phosphorus (66%) was concentrated in the leaves and stems. Other plant constituents also showed some partitioning within the plant tissue. For example, leaves contained the highest percentage of crude protein and the lowest percentage of ash. The stems contained the largest portion of plant fiber. The amino acids content of water hyacinth leaves compares favorably with that of soybean and cottonseed meal. Mineral and vitamin concentrations also showed partitioning within various plant tissues. Iron, copper, and sulfur were concentrated in the roots, while magnesium was concentrated in the leaves. No toxic levels of lead, silver, cadmium, or chromium were detected in the leaf tissue. The roots contained over 50 times the amount of vitamin B12 present in the leaves. Water hyacinth could be an excellent source of proteins, vitamins, and minerals, and could be of particular value as a dietary supplement in countries where human diets are deficient in these nutrients. (Harris-Wisconsin)
W80-04660

WATER USE AND SUPPLY DEVELOPMENT PLAN--EXECUTIVE SUMMARY.
South Florida Water Management District, West Palm Beach.
June 1978. 40 p, 16 Fig, 10 Tab.

Descriptors: *Water supply, *Water quality, *Water resources, *Water use, *Florida, *Planning, *Water management(Applied), Water demand, Water development, Administration, Wastewater reuse, Irrigation, Demineralization, Salinity, Aquifers, Water storage, Water conservation.

This plan was prepared by the South Florida Water Management District (SFWMD), an agency having water quality and quantity management responsibility for 14 southernmost Florida counties. Largely a flat area with subtropical vegetation and sawgrass, the SFWMD experiences its driest months from November through May, with water supply lowest during February. Major water uses are municipal, agricultural irrigation, Everglades National Park use, self-supplied industrial, power development, and salinity control. Consideration is given to the multiobjective approach to water resources management, whereby water supply must be managed so as to meet adequately the needs of economic development, environmental protection, drainage, flood control, and water storage. Recommendations for district water management include: encouraging better water conservation through practice and public education; supporting the development of wellfields and backpumping of the lower East Coast canals; implementation of regional demineralization facilities; deep acquifer storage and increased storage in Lake Okeechobee; wastewater reuse through support of local government and utility efforts; and support of U.S. Corps of Engineers study on wastewater reuse as an alternative water supply source. The rationale for each recommendation is presented, along with specific concerns, implementation and local action. (Arnold-NC)
W80-04746

ANALYSIS OF STRUCTURAL AND NON-STRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-04772

EMERGING TRENDS IN THE USE OF INTERNATIONAL LAW AND INSTITUTIONS FOR THE MANAGEMENT OF INTERNATIONAL WATER RESOURCES,
Denver Univ., CO.
For primary bibliographic entry see Field 6E.
W80-04787

ONCE-RELEASED IRRIGATION WATERS: LIABILITY AND LITIGATION,
For primary bibliographic entry see Field 6E.
W80-04789

4B. Groundwater Management

THE LONG ISLAND EXPERIENCE WITH WATER RETENTION AND RECHARGE MANAGEMENT,
Geological Survey, Syosset, NY. Water Resources Div.
D. A. Aronson.
In: Managing the Demand for Recreation and Tourism: Proceedings of workshop held in Ocean City, Maryland, September 27-29, 1978. Co-sponsored by the Cooperative Extension Services of Delaware, Maryland, New Jersey and Virginia, p 48-51, 1978. 12 Ref.

Descriptors: *Groundwater recharge, *Retention, *Artificial recharge, *Reclaimed water, *Water supply, Water storage, Water table, Storm runoff, Watersheds(Basins), Controlled drainage, Infiltration, Recreation, New York, *Long Island(NY).

Ground water is the sole source of freshwater for the residents of Nassau and Suffolk Counties on Long Island, N. Y. The ground-water reservoir is recharged only by local precipitation seeping from the land surface to the water table. Rapid urbanization of Nassau County caused a reduction of natural recharge as storm runoff from paved surfaces was carried to coastal waters through storm sewers. In 1935, Nassau County began to construct large basins to impound storm water and to return it to the ground-water reservoir by infiltration through underlying deposits. The use of storm-water basins not only helps to conserve storm runoff and to augment the freshwater reservoir, but it also has eliminated the need for long, costly trunk storm sewers to carry storm runoff to tidewater. Storm-water basins on Long Island are open pits excavated in permeable sand and gravel deposits of glacial origin. Basins dispose mostly of storm runoff from residential, industrial, and commercial areas and from highways. At present (1978), more than 2,500 storm-water basins are in operation in Nassau and Suffolk Counties. (Kosco-USGS)
W80-04545

AQUIFERS IN WALWORTH COUNTY, SOUTH DAKOTA,
Geological Survey, Garden City, KS. Water Resources Div.
J. Kume.
South Dakota Geological Survey Information Pamphlet No 18, 1979. 4 p, 3 Fig.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water quality, *South Dakota, Water yield, Water wells, Pumping, Water utilization, Aquifer systems, Walworth County(S Dak).

The water in four glacial-outwash sand and gravel aquifers in Walworth County, South Dakota, generally is of suitable quality for domestic, stock, municipal, and irrigation use. The Grand aquifer underlies about 106 square miles, averages 39 feet in thickness, and may yield as much as 600 gallons per minute to a pumping well. Three smaller aquifers composed of glacial-outwash sand and gravel, yield from 30 to 400 gallons per minute to individual wells. The Java sand and gravel aquifer consists of glacial outwash and preglacial stream sediment. The aquifer underlies about 100 square miles, averages 22 feet in thickness, and may yield as much as 50 gallons per minute to a pumping well. The Dakota and Fall River sandstone aquifers are the major bedrock aquifers that underlie the area. The Dakota aquifer is about 130 feet thick at an average depth of 1,940 feet. Its water is of the sodium chloride type. The Fall River aquifer ranges in thickness from about 140 to 200 feet at an average depth of 2,100 feet. Its water is of the calcium sulfate type. Water from these bedrock aquifers is used for domestic and stock purposes, but is too highly mineralized to be suitable for irrigation. (Kosco-USGS)
W80-04555

HYDROGEOCHEMICAL PROCESSES AFFECTING THE MIGRATION OF RADIONUCLIDES IN A FLUVIAL SAND AQUIFER AT THE CHALK RIVER NUCLEAR LABORATORIES,
National Hydrology Research Omst/. Ottawa (Ontario).
R. E. Jackson, and K. J. Inch.
NHRI Paper No 7, Scientific Series No 104, 1980. 58 p, 33 Fig, 25 Tab, 85 Ref, 1 App.

Descriptors: *Hydrogeochemical controls, *Radionuclides, *Groundwaters, *Aquifers, *Sediments, *Radioactive wastes, *Minerals, Migration, Adsorption, Treatment processes, Radioactivity.

In the mid-1950s, two experimental disposals of liquid radioactive waste containing approximately 700 curies (Ci) of 90Sr and 137Cs were made into shallow pits dug into the sandy ground of one of the disposal areas at the Chalk River Nuclear Laboratories (CRNL). The disposal area is part of the recharge area of a shallow groundwater flow system of approximately 1 km in length containing two aquifers-the Middle and Lower Sands units. In the past 25 years, the radioactive wastes have migrated into both aquifers and have chromatographically separated into 90Sr and 137Cs plumes. These plumes are moving at characteristic velocities much less than the velocity of the transporting groundwater. For 90Sr, this characteristic velocity is 3% of that of groundwater; for 137Cs, it is about 0.3%. The objectives of this study are (1) to investigate the hydrogeochemical controls on the migration of sampling, preservation and analysis of contaminated groundwaters and aquifer sediments. For studies of groundwater quality or pollution it is concluded that EH measurements should be complemented with measurements of dissolved oxygen and sulphide, since these can give an independent assessment of the redox level of a groundwater. Three distinct redox zones seem to exist in the groundwater flow system-oxygen, iron manganese and sulphide. The mobility of multivalent transition metals and nonmetals varies in these zones. (WATDOC)
W80-04567

REFLECTIONS ON GROUND WATER MANAGEMENT,
California State Water Resources Control Board, Sacramento.
W. D. Maughan.
Irrigation Journal, Vol 30, No 1, p 50, January-February, 1980.

Descriptors: *Ground water, *Water management(Applied), Overdraft, Arid lands, Ground water mining, Local governments, Imported water, Adjudication procedure, Water rights.

Lack of ground water management in many basins has led to water level decline and the threat of overdraft, subsidence, water quality deterioration and loss of wells and aquifers. In some basins this trend has been reversed by the establishment of a local ground water management program. In other basin, local capabilities are inadequate to recover from overdraft and the only solutions are adjudication of water rights or intentional mining. For large basins, importation is thought to be the best solution but may take years to implement due to entangling litigation, interstate negotiations, and construction. It is practicable for private, local, and state roles in ground water management to be worked out satisfactorily, provided new concepts and principles are jointly developed. A formula should be developed and used within the next three to five years, if real serious consequences are to be avoided. (Purdin-NWWA)
W80-04762

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF WOOD PRODUCTS HARVEST ON FOREST SOIL AND WATER RELATIONS,
Northeastern Forest Experiment Station, Parsons, WV. Timber and Watershed Lab.
J. H. Patric.
Journal of Environmental Quality, Vol 9, No 1, p 73-80, January-March 1980. 4 Fig, 10 Tab, 31 Ref.

Descriptors: *Forests, *Forest watersheds, *Clear-cutting, *Appalachian Mountain region, *West Virginia, Erosion, Water quality, Runoff, Watersheds(Basins), Forest management, Effects, Sediments, Suspended solids, Dissolved solids, Water temperature, Streamflow, Reforestation, Vegetation regrowth, Forestry, Hydrology.

The effects of silvicultural treatments on streamflow have been evaluated for 20 years on a 34.7-ha forested catchment on the Fernow Experimental Forest, near Parsons, in north-central West Virginia. Selection harvest of 13, 8, and 6% of the basal area in 1958, 1963, and 1968, respectively, had negligible effect on any measured property of water. In 1969-1970, 31.7 ha were harvested by clear-cutting, leaving a 3.0-ha protective strip of lightly cut forest extending about 20 m along both sides of the stream channel. This treatment had no effect on stormflow or stream temperature, but water yield increased 253 mm (38%) during the first year after cutting. Concentrations of sediment, nitrate, calcium, magnesium, potassium, and sodium in streamflow increased slightly. These effects on water quality were held to low levels by the protective strip and prudent management of logging roads. Subsequent cutting of the protective strip and clearing the stream channel in 1972 increased water yield 40 mm (9%) and raised stream temperature as much as 7.8C. Luxuriant regrowth over the entire watershed reduced all effects on water within 2 years after each treatment, and no effect from any treatment was measurable after 1977. (Sims-ISWS)
W80-04519

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
For primary bibliographic entry see Field 6E.
W80-04573

WATER BASED RECREATIONAL DEVELOPMENTS IN MICHIGAN - PROBLEMS OF DEVELOPERS,
Wayne State Univ., Detroit, MI.
For primary bibliographic entry see Field 6E.
W80-04591

URBAN HYDROLOGY IN KARST AND WATER QUALITY--INORGANIC AND ORGANIC SYSTEMS,
Indiana Univ. at Bloomington. Water Resources Research Center.
R. V. Ruhe, D. W. Clark, and M. L. Epstein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174303, Price codes: A07 in paper copy, A01 in microfiche. Report of Investigations No 9, March 1980. p 139, 28 Fig, 23 Tab, 27 Ref, 2 Append. OWRT-C-7681 (No 7256)(3), 14-34-0001-7256.

Descriptors: *Storm runoff, *Water quality, *Urbanization, *Karst, Rainfall, Runoff, Flow duration, Response time, Impervious cover, *Inorganic components, Dissolved load, Particulates, *Organic compounds, Modeling, Urban hydrology, *Pollutants, *Bloomington, Indiana, *Volatile compounds, *Non-volatile compounds, Paraffinic acids, Pesticides, Polychlorinated biphenyls.

Storm runoff and water quality were studied in ten watersheds with little to increasingly greater urbanization in karst terrain in the Bloomington, Indiana area. Among rainfall, storm runoff, flow duration, and response time, total storm flow relates best to, and directly to total rainfall. This effect increases as impervious cover increases among the watersheds whose characteristics include size, cover, slope, drainage lengths, and density. Storm peak discharge increases as size increases. Duration of storm runoff and response time decrease as impervious cover increases. Karst complicates the system. Storm runoff in one watershed is transferred underground and causes delayed high stream flow in another waterahed. Some inorganic components in the dissolved load decrease with increased storm discharge but others increase as particulates increase. Effluent from the

sanitary waste facility and runoff from streets and parking areas cause concentrations above normal of some components in dissolved and particulate loads in receiving waters. Storm runoff contains many volatile organic compounds and paraffinic oils, polycyclic aromatic hydrocarbons, fatty acids, pesticides, and polychlorinated biphenyls among non-volatile compounds. During storm runoff, patterns of concentrations of inorganic and organic compounds in hydrographs are very complex. Generalizations lead to over-simplification and perhaps meaningless modeling.
W80-04597

LIMNOLOGICAL STUDIES IN MONTANA: HYALITE RESERVOIR AND RESPONSES OF LOTIC PERIPHYTON TO DEEP-WATER DISCHARGES, GRAZING AND LOGGING,
Montana State Univ., Bozeman. Dept. of Microbiology.
M. D. Marcus, J. E. Schillinger, and D. G. Stuart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176134, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Center. Montana State University, Publication No 92, August 1978. 156 p, 28 Fig, 23 Tab, 121 Ref, 2 Append. OWRT C-7054 (No 6207)(2), 14-34-0001-6207.

Descriptors: *Aquatic environment, *Biological communities, *Limnology, *Environment effects, Pollutant identification, Water quality, Reservoirs, Surface waters, Diatoms, Periphyton, Chlorophyll, *Montana, Hyalite Reservoir(Mont), Hyalite Creek(Mont), Bozeman Creek(Mont), Southcentral Montana, Deep-water discharge, Logging activities, Cattle grazing, Aphanizomenon flos-aquae.

Physical, biological and chemical parameters were studied at three sites from May 18 to October 16, 1976, to develop limnological data for Hyalite Reservoir in Southcentral Montana. Physio-chemical parameters and periphyton dynamics were investigated at a number of sites on three creeks in the vicinity of Bozeman, Montana, to evaluate impacts on water quality from (1) deep-water discharges, (2) logging activities, and (3) cattle grazing. Nutrient concentrations were greatest near the reservoir outlet and were strongly influenced by wind action and the deep-water discharge. Highest chlorophyll-a concentrations and primary production occurred nearest the dam. An Aphanizomenon flos-aquae bloom in the reservoir appeared to result from low nitrogen and carbon dioxide concentrations. Primary production in the reservoir and at stream sites was also nitrogen limited. Reservoir discharges releasing nitrogen stimulated periphytic productivity, improved the physiological condition of the primary producers and increased diatom species diversity. Logging activities had no apparent impact on periphyton; cattle grazing increased periphytic productivity and decreased diatom diversity. Toxins released from old growths on diatomers and low water temperatures appear to inhibit periphyton growth. (Hunt-Mont)
W80-04670

CONFLICTS IN ATTAINING NATIONAL GOALS FOR BOTH WATER QUALITY AND ENERGY PRODUCTION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
For primary bibliographic entry see Field 6D.
W80-04755

4D. Watershed Protection

PLANTING WHEEL TRAFFIC EFFECTS ON INTERROW RUNOFF AND INFILTRATION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 2G.
W80-04641

SOIL CONSERVATION AND WATER POLLUTION CONTROL: THE MUDDY RECORD OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
Nebraska Univ., Omaha.
For primary bibliographic entry see Field 6E.
W80-04791

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TRIFLURALIN MOVEMENT IN RUNOFF FROM A SMALL AGRICULTURAL WATERSHED,
Science and Education Administration, Tifton, GA.
For primary bibliographic entry see Field 5B.
W80-04518

PERSISTENCE OF FLURIDONE IN SMALL PONDS,
Fisheries and Marine Service, Winnipeg (Manitoba). Dept. of Fisheries and Ocean.
For primary bibliographic entry see Field 5B.
W80-04524

STORM WATER MANAGEMENT MODEL VERIFICATION - HAMILTON TEST CATCHMENT.
Gore and Storrie Ltd, Toronto (Ontario).
Environmental Protection Service, Ottawa, Ontario, Training and Technology Transfer Division (Water). Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 99, 1980. 92 p, 31 Fig, 11 Tab, 12 Ref. 74-8-6.

Descriptors: *Water quality, *Watershed topography, *Rainfall rate, *Runoff quality, *Pollutants, Data collections, Quality simulation models, Sewer systems, Hydrographs, Great Lakes, Ontario, Canada.

A residential test catchment in Hamilton, Ontario, was selected and equipped with a data acquisition system for the collection of rainfall data, and quantity and quality urban runoff data. The test catchment was served by a combined sewer system and comprised an area of 71 ha (176 acres). The hydrologic and physical characteristics of the watershed, the criteria adopted for the selection of the instrumentation system, its installation and the data collection procedure used are described. The results of data analysis and the calibration and verification results of the U.S. Environmental Protection Agency's Storm Water Management Model (SWMM) are discussed in detail and are presented in tabular and graphical forms. These results confirmed the reliable performance of the SWMM runoff quantity model as indicated by the reasonable agreement of the simulated hydrographs with observed values. On the other hand, the quality model used did not produce acceptable correlation between measured and simulated pollutographs when calibration was attempted on an event basis for some pollution parameters. (WATDOC)
W80-04566

URBAN HYDROLOGY IN KARST AND WATER QUALITY--INORGANIC AND ORGANIC SYSTEMS,
Indiana Univ. at Bloomington. Water Resources Research Center.
For primary bibliographic entry see Field 4C.
W80-04597

ANALYSIS OF RIVERS AND STREAMS OF SOUTHERN MISSOURI FOR EPA PRIORITY POLLUTANTS USING LIQUID CHROMATOGRAPHY,
Missouri Univ.-Rolla.
J. O. Stoffer, and C. M. Ratkey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173560, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Missouri, Completion Report, March 1980. p 30, 6 Fig, 4 Tab, 10 Ref. OWRT A-104-MO(1), 14-34-0001, 8027, 9027.

Descriptors: *Water analysis, *Pollutants, *Organic compounds, *Waste water(Pollution), Watersheds(Basins), Missouri, Southern Missouri, Analytical techniques, Benzene, Carbon tetrachloride, Chloroform, Vinyl chloride, Bromoform, Pentachlorophenol, P-dichlorobenzene, PCB, 1, 1, 2-trichloroethylene, Organic pesticides, 3, 4-benzpyrene, Atrazine, Roundup, Lasso, Sencor, Paraquat.

The authors compare two methods of trace enrichment of organic pollutants likely to be found in rivers, streams and wastewater of Southern Missouri. Recovery data indicates sub parts per billion concentration levels are detectable with one method while a 15 minute on site enrichment at the sub parts per million level is possible with the other method. Various means of identification along with their lower concentration limits are also discussed. Among these identification methods discussed are GC/MS/DS, conventional U.V. analysis, rapid scan U.V. spectrophotometry, and high pressure liquid chromatography with data handling capabilities. The results of analysis of river water samples showed remarkably clean conditions prevail in the remote southern Missouri streams. Compounds tentatively identified include phthalates, phenols, branched hydrocarbons, and chlorinated hydrocarbons along with other more complex compounds. Variations in liquid chromatograms using the two different methods were noted. These variations can be attributed to differences in the work-up procedure and to the amount of sediment present in the water sample. Overall reproducabilities for the two methods are tabulated and show consistent recoveries with linear response to change in concentration.
W80-04598

MEASUREMENT OF PHYTOPLANKTON GROWTH BY PARTICLE COUNTING,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
R. W. Sheldon.
Limnology and Oceanography, Vol 24, No 4, p 760-767, July 1979. 9 Fig, 14 Ref.

Descriptors: *Phytoplankton, *Measurement, *Particle size, *Growth rates, *Detritus, Size, Equations, Estimating, Estimating equations, Mathematical studies, Biomass, Curves, Methodology, Analytical techniques, Diurnal, Microscopy, Sampling, Organic matter, Diatoms.

Phytoplankton growth rates can be measured in natural waters by particle counting, but experimental procedures are not routine. Each experiment has to be carefully planned and diurnal growth variations must be recognized. Asymptotic approximations cannot be used. Attention should be given to several points: (1) Growing material must be identified either with microscopes or by chemical determinations. (2) The size range over which growth occurs is identified on a size spectrum. Over a restricted size range phytoplankton grows essentially free of detritus, exhibiting an exponential growth pattern. (3) Experimental error must be minimized. Sample variation is reduced when all samples are taken from one large bottle. Large counts minimize counting errors. (4) Enough samples must be taken to define growth patterns; different experiments must take place. A preliminary run determines what is growing and the size range. In a second experiment, diurnal growth variations are established. Finally, a third experiment checks long-term growth patterns. Methods described by Cushing and Nicholson have produced obvious anomalies in past experiments due to the mathematical form of growth relationships. In phytoplankton growth studies in Bedford Basin, Nova Scotia, particle counting of a diatom bloom measured 15 March 1976, indicated that particulate matter was 99% detritus and 1% phytoplankton. Those growth constants best fit an asymptotic function. This shows that in practical terms, estimating phytoplankton growth by particle counting is not possible either by curve fitting or by Cushing and Nicholson methods. (Danovich-Wisconsin)
W80-04648

QUANTIFICATION OF NON-POINT WATER POLLUTANTS FROM LOGGING, CATTLE GRAZING, MINING, AND SUBDIVISION ACTIVITIES,
Montana State Univ., Bozeman. Dept. of Microbiology.
J. E. Schillinger, and D. G. Stuart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174063, Price codes: A16 in paper copy, A01 in microfiche. Montana Water Resources Research Center. Montana State University Report No 93, 1978. 366 p, 97 Fig, 59 Tab, 319 Ref, 2 Append. OWRT-C-7054 (No 6207)(1), 14-34-0001-6207.

Descriptors: *Water quality, *Watersheds(Basins), Streamflow, Monitoring, *Water pollution sources, Stream pollution, Water chemistry, Bioindicators, Sediment, *Grazing, *Mining, *Logging(Lumber), *Urban runoff, Suburban areas, Geology, Storm runoff, Snowmelt, Elevation, Gradient(Stream), *Land use, Temperature, Conductivity, Turbidity, Alkalinity, Ammonia, Calcium, Chlorides, Magnesium, Nitrates, Nitrites, Potassium, Sodium, Sulfates, Bozeman Creek, Hyalite Creek, Gallatin County, Montana, Non-point source, Cattle grazing index, Clearcutting, Fecal coliforms, Fecal streptococci, Orthophosphate, Standard plate count, Enterobacter, Klebsiella, Leptospiria, Multiple regression, Factor analysis.

Water quality data were collected over a two-year period in at 57 points in the Hyalite Creek and Bozeman Creek watersheds in southwestern Montana to determine the contribution of different activities to changes in the water chemistry, suspended sediment levels, and bacterial indicator count in streamflow. Cattle grazing increased fecal coliform; a cattle grazing index is formulated and correlated with the fecal coliform concentration and is shown as a function of a grazing management rating to relate a cattle management system to water quality. Clearcut logging did not significantly effect water quality. Although soil erosion occurred in clearcut areas, little sediment reached the streams from disturbances more than 30m away. Stormwater runoff, septic tank drainfields and construction in subdivisions in urban and suburban areas significantly altered the bacteriological and chemical quality and amount of suspended sediment in stream. Effects of groundwater seeping through a lead mine operated intermittently adjacent (300m) to stream were insignificant on water quality. A factor analysis indicates natural processes (1) correlate significantly with changes in water quality in high mountain streams than logging and grazing, and (2) do not correlate significantly in urban and suburban developments. Bacteriological analysis indicates Klebsiella and Enterobacter may indicate pollution from storm sewers and septic tanks better than total coliform. Methods for in situ and in vitro examination of leptrospires are presented.
W80-04669

OXYGEN CONTENT AND TOXICITY FOR FISH OF SOME SUBSTANCES IN HEATED WATERS,
Institute of Meteorology and Water Management, Warsaw (Poland). Dept. of Water Economics.
M. Gadkowski, A. Lysak, and B. Kokurewicz.
Polish Ecological Studies, Vol 5, No 3, p 18-23, 1979. 1 Tab.

Descriptors: *Toxicity, Water pollution effects, *Phenol, *Zinc, *Copper, *Cadmium, *Mercury, *Water temperature, Cooling water, Electric power production, Electric power plants, Poland, Freshwater fish.

The heating of river waters by an electric power plant do not deteriorate the oxygen balance of the river. The effect of increased water temperature on the toxicity of phenols, zinc, copper, cadmium, mercury as indicated by the literature is inconclusive and not consistent. It is suggested that long term studies be conducted to determine the long range effects of toxicants on fish in heated waters. (Katz-EIS)
W80-04681

LETHAL TEMPERATURES FOR FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
L. Horoszewicz.
Polish Ecological Studies, Vol 5, No 3, p 24-32, 1979. 7 Fig.

Descriptors: *Water pollution effects, *Water temperature, Electric power plants, Freshwater fish, *Poland, *Vistula River(Poland), *Atlantic salmon, *Lethal temperatures, Bass, Pike, Perch, Acclimation, Temperatures, Catfish, Carp, Cyprinids.

Comparison of lethal temperatures for fish occurring in the mid- and low course of the Vistula River with predicted temperatures after heating of these sections leads to the hopeful conclusion that even maximal predicted temperatures will not be the immediate cause of mortality of fish moving freely in the heated environment. Mortality can take place in the case of sudden occurrence of extreme temperatures exceeding 34C, or in the case of carrying fry and juveniles by the current from unheated sections of the river. Stream-like discharge of warm water that is maintaining an unheated current along one of the banks is of basic significance for survival of the most valuable fish populations in our waters - migrating salmonid fish species - the Atlantic salmon, Salmo salar L. and the sea-trout, S. trutta L. (Katz-EIS)
W80-04682

FISH METABOLISM,
Institute of Applied Biology, Siedlce (Poland).
B. Jezierska.
Polish Ecological Studies, Vol 5, No 3, p 43-51, 1979. 6 Fig.

Descriptors: *Fish physiology, *Fish behavior, *Water temperature, *Vistula River(Poland), *Poland, Metabolism, Water pollution effects, Cooling water, *Thermal effluents, Salmon, Cold water fish, Warm water fish, Fresh water fish, Brown trout, Catfish, Dissolved oxygen, Critical oxygen content.

Heating of the aquatic environment results in an increase of the rate of metabolism in fishes, this being related to increased activity and higher rate of basic physiological processes. Rate of standard metabolism can become even twice higher in conditions predicted by the model of the effects of heated effluents on water temperatures in the Vistula River. When the temperatures exceed 28-30C and oxygen content falls below 6 mg/l, some disorders in metabolic processes may occur, such as decrease of gas exchange rate, 'anaerobic respiration', and their consequences for the organism. Changes of the temperature and of the oxygen content which do not exceed the above range usually result in an adaptation to the heated environment of most freshwater fish species of interest to this study. The longer the period of altered environment the more thorough is adaptation of fish to the conditions, although the character of adaptive changes affects also fish organism as such. This may result in a development of a new 'variety' of fish adapted to new environmental conditions. (Katz-EIS)
W80-04684

FEEDING OF FISH AND THEIR FEEDING GROUNDS,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
T. Backiel.
Polish Ecological Studies, Vol 5, No 3, p 72-79, 1979. 4 Fig.

Descriptors: *Fish physiology, *Fish diets, *Vistula River(Poland), Poland, Cooling water, *Thermal effluent, Aquiculture, Benthos, Sediments, Zooplankton, Channel morphology, Channel improvement, Backwater, Backwater areas, Fresh water fish, Water temperature, Warm water fish.

Material carried by the water (drift) will be reduced in proportion to the amount of water taken by the power plant. Thus, for example, the average water intake by the Kozienice electric power plant is only around 6.4% of the average flow and it can be expected that less than 6% of the live components drifted is destroyed. At low water levels and maximal output of the power plant this effect may be around 2.5 times higher, but even then the influence of the plant on this ground is only slight. Due to narrowing of the river bed and due to embankments in the region of any power plant and, consequently, acceleration of the current, the number of feeding grounds developing on a hard river bottom will increase. Such feeding grounds within the range of a warm water stream will become more abundant. Feeding grounds of silted, muddy bottom within the range of a warm water stream may become poorer. The influence of such a warm water stream on closed backwater areas, if any are left (see below), is significant. It is difficult to predict the changes in zooplankton, but one can assume that the benthos will undergo unfavourable changes, while vegetation and its accompanying fauna will show exhuberant development. About twofold increase of food requirements may not be met with by fish feeding on the muddy bottom, but will most likely be satisfied by fish grazing on fauna which develops on hard objects in the river channel. (Katz-EIS)
W80-04687

THE IMPACT ON ICHTHYOFAUNA AND POSSIBLE CONTROL OF THE EFFECTS OF THERMAL DISCHARGE,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
T. Backiel, M. Gadkowski, and L. Horoszewicz.
Polish Ecological Studies, Vol 5, No 3, p 100-107, 1979. 1 Fig, 2 Tab.

Descriptors: *Water pollution effects, *Aquiculture, *Vistula River(Poland), *Poland, Water temperature, Monitoring, *Fish population, Thermal powerplants, Growth, Fish reproduction, Fish diets, Fish behavior, Fish physiology.

The series of papers are briefly synthesized under two main groups: (1) The predicted changes in the river environment affected by the power plant and (2) the predicted changes and the possible deleterious effects in the fish population resulting from the effects of the power plant on the river environment. Also discussed are the adaptation of fish to heated waters, the acceptable variations in water temperature and the maximum tolerated temperatures, the distribution of water temperature in the Vistula River and the changes in the river bed. The possibilities of reducing the adverse effects of heated effluents, the monitoring of fish population and the use of the effluents in fish farming. (Katz-EIS)
W80-04691

TISSUE METAL CONCENTRATIONS IN TWO CRAYFISH SPECIES COHABITING A TENNESSEE CAVE STREAM,
Savannah River Ecology Lab., Aiken, SC.
G. W. Dickson, L. A. Briese, and J. P. Giesy, Jr.
Oecologia, Vol 44, p 8-12, 1979. 1 Fig, 3 Tab, 32 Ref.

Descriptors: *Metals, *Crayfish, *Absorption, *Cadmium, *Chromium, *Copper, *Iron, Magnesium, Manganese, *Lead, *Zinc, Calcium, Potassium, Toxicity, Mortality, Animal behavior, Fecundity, Life History Studies, *Tissue analysis, *Bioaccumulation, Tennessee, White County(Tenn).

Concentrations of Cd, Cr, Cu, Fe, Mg, Mn, Pb, Zn, Ca and K were examined in tissues of the troglobitic (obligatory cave-dwelling) crayfish Orconectes australis australis and troglophilic (facultative cave-dwelling) species Cambarus tenebrosus. These two species cohabit a stream in Merrybranch Cave, located in rural White Co., Tennessee. Tissue concentrations of essential metals did not exhibit any trends between species. In contrast, Cd and Pb concentrations were found to be significantly greater in O. australis for almost all of the tissues analyzed. The higher Cd and Pb concentrations in O. australis are thought to be due to the increased longevity of this troglobitic species. Because of the toxicity of Cd and Pb, chronic exposure to relatively low concentrations of these

metals could cause changes in mortality, fecundity or behaviour in aquatic organisms possessing long life spans. The bioaccumulation of metals from low level, non-point sources is discussed in relation to life history strategies. (Deal-EIS)
W80-04696

TOXICITY OF BUTOXYETHYL ESTER OF 2,4-D TO SELECTED SALMON AND TROUT,
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).
D. W. Martens, R. W. Gordon, and J. A. Servizi.
Progress Report No 40, 1980. 18 p, 1 Fig, 5 Tab, 13 Ref.

Descriptors: *2,4-D, *Bioassay, *Salmonids, *Toxicity, Sockeye salmon, Pink salmon, Rainbow trout, Fry, Growth stages, Pesticide toxicity, Lethal limit, Mortality, Chemical properties, Pesticide kinetics, Microbial degradation, *Aqua-Kleen.

Sockeye, coho and pink salmon and rainbow trout were exposed to butoxyethyl ester of 2,4-D (BEE) derived from Aqua-Kleen 20 in semi-static acute and chronic bioassays. The 96 hr LC50 was approximately 0.45 mg/l BEE for sockeye fingerlings, coho fry and pink fry. Rainbow trout were slightly more sensitive to BEE than the salmon tested. Sockeye smolts and pink salmon fry survived transfer to seawater after 24 hour exposure to concentrations of BEE nearly equal to the 96 hr LC50. Pink and coho salmon and rainbow trout were shorter than control specimens at yolk absorption following exposure to 0.220 mg/l BEE during the alevin stage. No mortality or distress was observed among sockeye fingerlings exposed to 200 mg/l 2,4-D acid for 168 hours. The influences of bacterial activity, temperature and pH on hydrolysis of BEE to 2,4-D acid are discussed. (Deal-EIS)
W80-04700

PRODUCTION, MORTALITY, AND POWER PLANT ENTRAINMENT OF LARVAL YELLOW PERCH IN WESTERN LAKE ERIE,
Environmental Research Lab. Duluth, MN.
R. L. Patterson.
Report EPA-600/3-79-087, 1979. 199 p, 45 Fig, 40 Tab, 7 App, 23 Ref.

Descriptors: *Powerplants, *Entrainment, *Yellow perch, *Mortality, *Lake Erie, Growth stages, Larval growth stage, Perches, Fish populations, Fish management, Mathematical models, Monroe Power Plant(Mich), *Impingement.

This study assessed impacts of the Monroe Power Plant upon the yellow perch population of Western Lake Erie caused by entrainment and impingement of larvae and older fishes in the plant's open cycle cooling system in 1975-76. Estimates of total numbers of perch larvae entrained, total perch production, the natural mortality rate of perch, and the percentage of perch production that was entrained by the Monroe Power Plant were obtained for 1975-76. Impingement estimates were obtained from data supplied by the power plant. The above estimates consider only effects that occur in the same year in which entrainment and impingement occurs. Impacts may occur in subsequent years which include a depression of fish stocks and reduced yields to the fishery. Losses to the standing stocks and fisheries were estimated using a method which falls into a category known as the 'equivalent-adult' type which provided estimates of the long-run annual depression of yellow perch standing stocks and the yellow perch fisheries. A numerical model was developed which incorporated several population parameters including entrainment and impingement losses, and natural mortality rates for larvae, young-of-year and juveniles, and fishing mortality rates. (Deal-EIS)
W80-04701

THE EFFECT OF TEMPERATURE ON THE RESPIRATION RATE OF MEIOFAUNA,
Institute for Marine Environmental Research, Plymouth (England).
R. Price, and R. M. Warwick.
Oecologia, Vol 44, p 145-148, 1980. 2 Fig, 1 Tab, 19 Ref.

Descriptors: *Water temperature, *Respiration, *Inhibition, *Copepods, *Nematodes, Animal metabolism, Animal physiology, Benthic fauna, Statistical analysis, Mathematical models, *Polychaetes.

The effect of temperature on respiration rate has been established, using Cartesian divers, for the meiofaunal sabellid polychaete Manayunkia aestuarina, the free-living nematode Sphaerolaimus hirsutus and the harpacticoid copepod Tachidius discipes from a mudflat in the Lynher estuary, Cornwall, U.K. Over the temperature range normally experienced in the field, i.e., 5-20C the size-compensated respiration rate (Rc) was related to the temperature (T) in C by the equation Log10Rc = -0.635 + 0.0339T for Manayunkia, Log10Rc = 0.180 + 0.0069T for Sphaerolaimus and Log10Rc = -0.428 + 0.0337T for Tachidius, being equivalent to Q10 values of 2.19, 1.17 and 2.17 respectively. (Deal-EIS)
W80-04703

TOXIC DINOFLAGELLATES AND TIDAL POWER GENERATION IN THE BAY OF FUNDY, CANADA,
Institute for Marine Environmental Research, Plymouth (England).
P. C. Reid.
Marine Pollution Bulletin, Vol 11, p 47-51, 1980. 2 Fig, 34 Ref.

Descriptors: *Dinoflagellates, *Algal toxins, *Tidal energy, *Tidal powerplants, *Shellfish, Poisons, Tides, Flow profiles, Water circulation, Powerplants, Sedimentology, *Paralytic Shellfish Poisoning, *Bay of Fundy(Canada), Public health.

The incidence of Paralytic Shellfish Poisoning along the eastern seaboard of America has increased and spread during the last decade. One of the core areas for Paralytic Shellfish Poison (PSP), a poison that is derived from toxic dinoflagellates, is centred on the Bay of Fundy. It is in the upper reaches of the Bay of Fundy that a proposal has been made to construct a tidal power generation plant; this project would have a considerable effect on the water circulation, tidal regime and sedimentation characteristics of the Bay of Fundy and Gulf of Maine. Alterations such as these to the hydrography of this area may lead to changes in the occurrence of toxic dinoflagellates and the associated patterns and intensity of PSP. (Deal-EIS)
W80-04704

POLYCHLORINATED BIPHENYLS AND OTHER ORGANIC CHEMICAL RESIDUES IN FISH FROM MAJOR WATERSHEDS OF THE UNITED STATES, 1976,
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W80-04706

A SIMPLE CONTINUOUS-FLOW TOXICANT DELIVERY SYSTEM,
Corvallis Environmental Research Lab., OR.
R. R. Garton.
Water Research, Vol 14, p 227-230, 1980. 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Research equipment, *Bioassay, *Methodology, Laboratory equipment, Equipment, *Toxicity, Water chemistry, Research and development, Chemical analysis, Chemical properties, *Aquatic organisms.

This paper describes a simple continuous-flow toxicant delivery system for use in testing toxicity of dissolved or suspended compounds to aquatic organisms. Its advantages are simplicity, ease of construction, and capacity for high flow rates. The system consists of a glass headbox and diluter box, a toxicant pump, a framework for support, and a system of tubes to deliver a series of toxicant concentrations to the test aquaria. Methods are given for construction and for calibration of the system. (Deal-EIS)
W80-04707

COMPARISON OF THE TOXICITY THRESHOLDS OF WATER POLLUTANTS TO BACTERIA, ALGAE, AND PROTOZOA IN THE CELL MULTIPLICATION INHIBITION TEST,
Bundesgesundheitsamt, Berlin (Germany, F. R.). Inst. fuer Wasser-, Boden-, und Lufthygiene.
G. Bringmann, and R. Kuhn.
Water Research, Vol 14, p 231-241, 1980. 10 Tab.

Descriptors: *Bioassay, *Methodology, *Water pollution effects, Chemical properties, Protozoa, Bacteria, Algae, Pseudomonas, Scenedesmus, Chlorophyta, Growth rates, Inhibition, Organic compounds, Aromatic compounds, Phenols, Inorganic compounds, *Toxicity.

Using analogous methods of the cell multiplication inhibition test, the toxicity threshold (TT) of 156 potential water pollutants was determined for model organisms of biological self-purification, i.e. bacteria of the species Pseudomonas putida, green algae of the species Scenedesmus quadricauda, and flagellate protozoa of the species Entosiphon sulcatum. From the number of 156 inorganic and organic pollutants tested, 23 exhibited a pronounced selective toxic action on Pseudomonas, 47 on Scenedesmus and 43 on Entosiphon. It is seen from the ratios found that a determination of the toxicity threshold of potential water pollutants for these three model organisms from the microbiological spectrum would provide a broader basis for assessing the damaging action of water pollutants to model organisms active in the biological self-purification of water. Ecotoxicological testing of potential water pollutants to evaluate their toxicity involving only one model organism of biological self-purification would give an incomplete and biased picture of the effects of pollutants. (Deal-EIS)
W80-04708

A PRESSURIZED PROPORTIONAL DILUTER FOR AQUATIC TOXICOLOGICAL STUDIES,
Environmental Research Lab., Gulf Breeze, FL.
M. J. Hemmer.
Water Research, Vol 14, p 243-246, 1980. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Research equipment, *Bioassay, *Toxicity, *Aquatic organisms, Siphons, Equipment, Laboratory equipment, Chemical reactions, Pumps, Chemical analysis, Methodology, Shrimp, Endrin.

A halt-liter proportional diluter using positive pressure was designed and tested. Its primary siphons are activated by a pulse of pressure instead of by a partial vacuum as in conventional diluters. This method eliminates the need for venturi tubes, vacuum manifolds, and individual water blocks. Pressure can be supplied by air pumps, air cylinders, or air compressor lines. The diluter's advantages are ease of construction, calibration, compact size, and rapid cleaning. Unit cost is approximately $250.00. (Deal-EIS)
W80-04709

CORRELATION AND PREDICTION OF METAL TOXICITY TO AQUATIC BIOTA,
National Water Research Inst., Burlington (Ontario).
K. L. E. Kaiser.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 211-218, 1980. 6 Tab, 24 Ref.

Descriptors: *Physioc-chemical properties, *Metals, *Ions, *Toxicity, *Daphnia, Aquatic life, Sodium, Aluminum, Chromium, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium, Mercury, Lead, Mathematical studies, *Arsenic, *Selenium, *Tin, Platinum, *Gold, *Beryllium, *Barium.

Published data on the toxicity of metal ions to aquatic biota, in particular Daphnia magna, were analyzed for their correlation with ion specific physicochemical parameters. Significant correlations were obtained for three groups of ions with similar electron configurations in the outer orbitals. Group I ions include Na, Be, Ba, Al, and Cr with inert gas-like electron configurations; group II ions include Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd, Pt,

Au, and Hg with partially or completely filled d electron orbitals; group III ions include Sn, As, Se, and Pb. The toxicity of an ion within a group can be calculated from a general equation. Delta IP. (Deal-EIS)
W80-04711

FACTORS CONTROLLING OXYGEN DEPLETION IN ICE-COVERED LAKES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
J. A. Mathias, and J. Barica.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 185-194, 1980. 4 Fig, 2 Tab, 38 Ref.

Descriptors: *Lakes, *Dissolved oxygen, *Winter, Seasonal, Trophic level, Eutrophication, Oligotrophy, Winterkilling, Oxygen demand, Respiration, Sediments, Canada, *Oxygen depletion.

Winter oxygen depletion rates from four sets of Canadian lakes (prairie, southeastern Ontario, Arctic, and Experimental Lakes Area) differing in morphometry and trophic state, were analyzed. An inverse relationship was found between oxygen depletion rate and mean depth. The effect of lake trophic status on oxygen depletion rate was demonstrable after the influence of basin morphometry was removed by regression of oxygen depletion rate against the sediment area: lake volume ratio. The sediments of eutrophic lakes consumed oxygen about 3 times faster (0.23 g/sq m/d) than those of oligotrophic lakes (0.08 g/sq m/d), but water column respiration was about the same (0.01 g/cu m/d) for both groups of lakes. Data from prairie lakes showed that the winter oxygen consumption was limited by oxygen supply below an average whole-lake oxygen concentration of 3.8 mg/l. Implications for lake management during the winter are discussed. (Deal-EIS)
W80-04712

THREE TYPES OF SKIN PAPILLOMAS OF FLATFISHES AND THEIR CAUSES,
Hamburg Univ. (Germany, F.R.). Zoologisches Inst.
N. Peters, and B. Watermann.
Marine Ecology - Progress Series, Vol 1, p 269-276, 1979. 9 Fig, 17 Ref.

Descriptors: *Fish diseases, *Cytological studies, *Mode of action, Fish physiology, Animal pathology, Viruses, Water pollution effects, Metals, Sulfur compounds, Marine fish, *Papillomas, *Tumors, *Limanda, *Tissue analysis, *Neoplasms, Titanium compounds.

Three structurally different skin papillomas occur in flatfishes. Apparently, different causative agents are responsible. (1) Flat 'fish pox'-like tumours with a low connective tissue content occur in the Atlantic dab Limanda limanda. The high rate of occurrence in the German Bight (up to 6.6%) might be related to the dumping of wastes consisting of sulphuric acid and titanium compounds. (2) Collagen-rich papillomas on the tip of the lower jaw appear on both Atlantic and Pacific flatfishes kept in aquaria over long periods of time. These develop as a result of mechanical stimulation of the tissue as the fishes rub against aquarium walls. (3) Complex papillomas, composed in a characteristic manner of so-called X-cells and envelope cells between them, are common in flatfishes of the Pacific region. The structure and the distribution of these complex papillomas indicate that a virus is probably involved. There also exists some relationship between tumour occurrence rate and degree of coastal water pollution. (Deal-EIS)
W80-04713

ACUTE RESIDUAL TOXICITY OF SEVERAL DISINFECTANTS IN DOMESTIC AND INDUSTRIAL WASTE WATER,
Grand Valley State Colleges, Allendale, MI. Dept. of Biology.
R. W. Ward, and G. M. DeGraeve.
Water Resources Bulletin, Vol 16, No 1, p 41-48, 1980. 6 Tab, 20 Ref.

Descriptors: *Waste treatment, *Toxicity, *Freshwater fish, Bioassay, Chlorination, Bromine, Halogens, Chlorine, Industrial wastes, Sulfur compounds, Carp, Salmonids, Bioassay, Domestic wastes, Mortality, Benthic fauna, Disinfection, Daphnia, Minnows.

This study determined the acute toxicity of waste water disinfected with chlorine, bromine chloride, or ozone. The residual toxicity of effluent dechlorinated with sulfur dioxide was also tested. Toxicity tests were conducted with cyprinid, salmonid, and centrachid fishes, as well as several species of fresh water macro-invertebrates. Residual chlorine exhibited the greatest toxicity of the disinfectants tested; dechlorination with sulfur dioxide effectively eliminated the toxicity of chlorinated effluent. Residual ozone produced mortality in test animals only under special conditions where subjects were exposed to effluent immediately after it was contacted with ozone, and chlorobrominated effluent was more toxic to salmonids than chlorinated effluent. (Deal-EIS)
W80-04717

USING ARTIFICIAL STREAMS TO EVALUATE PERTURBATION EFFECTS ON AUFWUCHS STRUCTURE AND FUNCTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. R. Clark, J. H. Rodgers, Jr., K. L. Dickson, and J. Cairns, Jr.
Water Resources Bulletin, Vol 16, No 1, p 100-104, 1980. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Periphyton, *Biological communities, *Streams, Bioassay, Flow rates, Dominant organisms, Aquatic populations, Methodology, Research and development, Research equipment, Water pollution effects, *Artificial streams.

Artificial streams can assist in assessing the potential impact of pollutants on the structure and function of aquatic communities. While most artificial streams are constructed within a controlled environment or are maintained by recirculating water, we constructed a series of artificial streams along a river bank using river water on a once-through basis. This system was used to develop and test methods for structural and functional analyses of Aufwuchs communities. Only the flow rate and stream depth were controlled while individual streams were perturbed to obtain communities of altered ecological condition. This experimental system provided a relatively inexpensive series of treated and untreated streams which allowed an evaluation and comparison of methods using communities under various stressed and non-stressed conditions. Without the stabilizing effects of a controlled atmosphere or recirculating water, our approach demonstrated a degree of variability which approached that of the river. We inferred that the Aufwuchs community present in the artificial streams maintained a high degree of structural complexity and functional dynamism, providing a strong test of our methods and an opportunity to examine current ecological theory. (Deal-EIS)
W80-04718

GROWTH INHIBITION OF HYDRILLA VERTICILLATA BY SELECTED LAKE SEDIMENT EXTRACTS,
Southwest Florida Water Management District, Brooksville.
P. M. Dooris, and D. F. Martin.
Water Resources Bulletin, Vol 16, No 1, p 112-117, 1980. 2 Fig, 1 Tab, 29 Ref.

Descriptors: *Growth rates, *Inhibition, *Aquatic plants, *Iron, Bioassay, Lakes, Bottom sediments, Soil chemistry, Chemical properties, Chemical analysis, Plant growth, Biomass, Florida, *Hydrilla.

Sediments were investigated from two Florida lakes that have not been infested with the submersed, perennial, noxious plant Hydrilla verticillata. Aqueous extracts of the peat-like sediments from these lakes were shown to inhibit the growth of Hydrilla verticillata in laboratory systems. The extracts have substantial concentrations of organic carbor and iron. The apparent molecular weight of the inhibitory fraction is between 2,000 and 10,000, based upon ultrafiltration studies. Hydrilla growth was about 35 percent relative to control for a partially purified fraction at a level of 0.4 ppm organic carbon. Growth was measured as change in biomass (wet and dry) over a one-week period. The inhibitory material was highly fluorescent, dark brown, and inhibitory activity was lost after passage over an anion-exchange column (Cellex-D). (Deal-EIS)
W80-04719

EFFECTS OF DIETARY ASCORBIC ACID ON CHRONIC LEAD TOXICITY TO YOUNG RAINBOW TROUT (SALMO GAIRDNERI),
Fisheries and Marine Service, Ottawa (Ontario). Great Lakes Biolimnology Lab.
P. V. Hodson, J. W. Hilton, B. R. Blunt, and S. J. Slinger.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 170-176, 1980. 7 Fig, 27 Ref.

Descriptors: *Lead, *Toxicity, *Rainbow trout, Fish diets, Vitamins, Nutrient requirements, Mode of action, Animal pathology, Fish diseases, Fish physiology, Water chemistry, *Tissue analysis, *Blood chemistry, *Ascorbic acid.

Newly hatched rainbow trout exposed to waterborne lead and receiving diets deficient in, or supplemented with, ascorbic acid, developed classical symptoms of lead toxicity and ascorbic acid deficiency. Those exposed to lead showed elevated blood lead concentrations, inhibition of erythrocyte Delta -amino levulinic acid dehydratase, darkening of the tail regions and spinal curvatures. Those receiving ascorbate deficient diets showed depletion of carcass, liver, kidney, and brain ascorbic acid concentrations plus spinal curvatures. Fish subjected to both treatments simultaneously showed no evidence of an enhancement of ascorbate deficiency symptoms by exposure to lead or enhancement or reduction of lead toxicity symptoms by ascorbate deficient or supplemented diets, respectively. These results demonstrate that, although aspects of lead toxicity in fish resemble ascorbic acid deficiency, there is no metabolic interaction between the two factors. (Deal-EIS)
W80-04720

EFFECTS OF TEMPERATURE AND SALINITY ON LARVAL DEVELOPMENT OF PAGURUS BERNHARDUS (DECAPODA, PAGURIDAE),
Biologische Anstalt Helgoland (Germany, F.R.).
R. R. Dawirs.
Marine Ecology-Progress Series, Vol 1, p 323-329, 1979. 12 Fig, 21 Ref.

Descriptors: *Water temperature, *Salinity, *Growth rates, *Crabs, Larval growth stage, Toxicity, Mortality, Salt tolerance, Mathematical models, Animal physiology, Water chemistry, Growth stages, Seasonal, Crustaceans.

The hermit crab Pagurus bernhardus L. was reared from egg to first crab stage at 6C, 12C and 18C. At 6C, development was completed after 107 to 112 d; at 12C, after 49 to 54 d; at 18C, after 33 to 35 d following hatching. Survival rates were 6.7% both at 6 and 18C; they were 20% at 12C. A simple graphical model was constructed which predicts occurrence, presence and settling of P. bernhardus larvae in the field. According to this model, in Helgoland waters (North Sea), duration of larval development lasts about 35 to 62 d, depending on the water temperature during and after hatching. Shortest development (about 35 d) is postulated for larvae hatching at the beginning of August. Complete rearing to metamorphosis was accomplished in 20% and 30% S (18C). In 10% S, Zoea 1 larvae exhibit 100% mortality 2 to 5 d after hatching. No differences in development duration, mortality, etc. were noticed at 20% and 30% S. The observation that a salinity of 20% does not cause recognizable stress is discussed in relation to local larval distribution. (Deal-EIS)
W80-04722

ACUTE TOXICITY OF HEAVY METALS TO AQUATIC INVERTEBRATES AT DIFFERENT TEMPERATURES,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
L. P. Braginskiy, and E. P. Schcherban.
Hydrobiological Journal, Vol 14, No 6, p 78-82, 1978. 4 Tab, 9 Ref.

Descriptors: *Heavy metals, *Toxicity, *Invertebrates, *Water temperature, Cadmium, Zinc, Copper, Nickel, Manganese, Daphnia, Mayflies, Lethal limit, Bioassay, Animal physiology, Mortality, Copepods, Benthic fauna, Aquatic insects, Copepoda, Amphipods, Asellus.

Comparative toxicity of Cd, Zn, Cu, Ni, Mn ions at temperatures of 10, 15, 25 and 30C within the concentration range of 0.0025-5000 mg/liter was measured in acute 3-day experiments on six species of freshwater invertebrates. Maximum sensitivity to heavy metal ions is characteristic of Daphnia magna Straus young. Acanthocyclops viridis, Mayflies larvae and Asellus aquaticus are least sensitive. Cadmium is most toxic, followed by copper, zinc, nickel and manganese. As the temperature is raised to 25 to 30C, cadmium toxicity increases by 3 to 4 orders of magnitude, that of copper and zinc by 1 to 3 orders. (Deal-EIS)
W80-04723

THE STUDY OF EUTROPHICATION OF ALGAL BENTHOS BY ESSENTIAL METALS IN ARTIFICIAL RIVERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
E. Eichenberger.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 111-128, 1978. 4 Fig, 8 Tab, 12 Ref.

Descriptors: *Heavy metals, *Eutrophication, *Rivers, Sewage effluent, Aquatic algae, Growth rates, Productivity, *Iron, *Manganese, *Cobalt, *Copper, *Zinc, Trophic level, Seasonal, Biomass, Trace elements, Toxicity, *Molybdenum.

The causes of eutrophication of rivers are being studied in artificial outdoor rivers. Small amounts of domestic sewage added to groundwater stimulates the growth of algae. This eutrophying effect cannot be duplicated by the supply of the same quantity of P04-P and/or N03-N as is found in the active sewage. The supply of a mixture of the 6 essential heavy metals Fe, Mn, Co, Cu, Mo and Zn on the other hand does affect the growth activity of the algae occurring naturally in the channels, whereby each metal most likely has a different effect. This results, depending on the season and the amount of mixture added, in changes of the sociological composition of the algal benthos and can considerably enhance the biomass accumulation. Due to the characteristic dose response of single algal species to individual metals the role of essential heavy metals in eutrophication is likely to be rather complex. (Deal-EIS)
W80-04726

GLYCERIA MAXIMA (HARTM.) HOLMB. IN PONDS SUPPLIED WITH POST-SEWAGE WATER,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5D.
W80-04730

ACIDITY AND SPECIES DIVERSITY IN FRESHWATER CRUSTACEAN FAUNAS,
Freshwater Biological Association, Windermere (England).
G. Fryer.
Freshwater Biology, Vol 10, p 41-45, 1980. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Acidic water, *Habitats, *Crustaceans, Dominant organisms, Lakes, Water chemistry, Acidity, Hydrogen ion concentration, *Calcium, Water temperature, *Species diversity, *Tarns.

On the basis of material from over seventy acidic water bodies in three different areas a relationship is revealed between pH and the species diversity of their crustacean faunas. With increasing acidity species diversity decreases. No such relationship is shown between calcium concentration and species diversity. The very low calcium levels of such waters may, however, play a part in the exclusion of certain species. (Deal-EIS)
W80-04731

CADMIUM TOXICITY TO THREE SPECIES OF ESTUARINE INVERTEBRATES,
Environmental Research Lab., Narragansett, RI.
G. G. Pesch, and N. E. Stewart.
Marine Environmental Research, Vol 3, p 145-156, 1980. 3 Fig, 5 Tab, 32 Ref.

Descriptors: *Cadmium, *Toxicity, *Crabs, *Shrimp, Heavy metals, Bioassay, Lethal limit, Mode of action, Mortality, Growth rates, Inhibition, Animal physiology, Invertebrates, Estuarine environment, *Scallop, *Argopecten, *Tissue analysis, *Bioaccumulation.

Three species of estuarine invertebrates, Palaemonetes pugio (grass shrimp), Pagurus longicarpus (hermit crab) and Argopecten irradians (bay scallop), were exposed to Cd in flowing seawater at concentrations of 0.06, 0.12, 0.25, 0.5 and 1.0 mg/litre. Incipient LC50 values of 0.53 and 0.07 mg/litre were estimated for bay scallop and hermit crab, respectively. The toxicity curve for grass shrimp had not stablished, but the incipient LC50 value was estimated to fall within a range of 0.2 to 0.3 mg/litre. Short-term response, as measured by time to 50% mortality at the highest Cd concentration, was 10, 21 and 23 days for the bay scallop, hermit crab and grass shrimp, respectively. Scallop growth was inhibited at all exposure concentrations with a measured 42-day EC50 value of 0.078 mg/litre Cd. Byssal thread detachment precedes death in bay scallops. An EC50 value of 0.54 mg/litre Cd for byssal detachment was measured on day 8 of the bioassay before appreciable mortality. This compared favourably with the incipient LC50 value of 0.53 mg/litre Cd. Cadmium accumulation occurred at all concentrations in bay scallop and grass shrimp. (Deal-EIS)
W80-04736

THE COMBINED EFFECT OF SALINITY, TEMPERATURE AND OIL ON THE GROWTH PATTERN OF EMBRYOS OF THE KILLIFISH, FUNDULUS HETEROCLITUS WALBAUM,
Texas A and M Univ., College Station. Dept. of Biology.
O. Linden, R. Laughlin, Jr., J. R. Sharp, and J. M. Neff.
Marine Environmental Research, Vol 3, p 129-144, 1980. 3 Fig, 4 Tab, 49 Ref.

Descriptors: *Killifishes, *Toxicity, *Oil, Water temperature, Salinity, Inhibition, Growth rates, Embryonic growth stage, Fish physiology, Oil spills, Oil pollution, Fuels, Fish diseases, Animal pathology, Mortality, *Teratology.

Embryos of the estuarine teleost, Fundulus heteroclitus, were exposed during development to different concentrations of the water-soluble fractions (WSF) of a No. 2 fuel oil under various temperature-salinity combinations. Temperatures and salinities were, respectively: 20, 25 or 30 and 10, 20 or 30 o/oo S. The WSF were extracted from No. 2 fuel oil daily and diluted to concentrations of 15, 20 or 25% of the original mixture. Controls were exposed to seawater without WSF at each temperature salinity combination. The length of eleutheroembryos was markedly decreased by exposure to WSF. Temperature exerted an effect on growth at low WSF concentrations (0 and 15% WSF) but not at higher ones. The two highest WSF concentrations had a predominant effect on growth that was not further modified by physical factor influences. Conversely, as the WSF exposure increased, the yolk diameter increased, indicating a decreased utilization of yolk material during development. The mean number of vertebrae in the eleutheroembryos decreased at high WSF concentrations and at high temperatures. Morphological abnormalities consisted predominantly of spinal deformations (scoliosis and lordosis). The data indicate that the survivors of chemical toxicity during embryo development exhibit sublethal responses which would reduce their survival potential in later life. (Deal-EIS)
W80-04737

A MARINE ALGAL BIOASSAY METHOD: RESULTS WITH PESTICIDES AND INDUSTRIAL WASTES,
Environmental Research Labs., Gulf Breeze, FL.
G. E. Walsh, and S. V. Alexander.
Water, Air, and Soil Pollution, Vol 13, p 45-55, 1980. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Bioassay, *Methodology, *Pesticide toxicity, *Industrial wastes, Toxicity, Marine algae, Diatoms, Growth rates, Inhibition, Pulp wastes, Herbicides, Spectrophotometry, Analytical techniques, *EPN, *Ethoprop, *Carbophenothion, *Methyl parathion, *DEF, *Phorate, *Carbaryl, *Benthiocarb, *Permethrin, *Neburon.

A simple marine algal bioassay method is described for short- and long-term studies on pesticides and industrial wastes. It can be used for rapid screening of a variety of substances with single-species and multiple-species tests and gives relative toxicities of the pollutants tested. Algae are grown in optically matched culture tubes that fit directly into a spectrophotometer, allowing population density to be estimated by absorbance without removal of samples. 96 h EC50 values for some pesticides and the diatom Skeletonema costatum are: EPN, 340 microg/l; carbophenothion, 109 microg/l; DEF, 366 microg/l; ethoprop, 8.4 mg/l; methyl parathion, 5.3 mg/l; and phorate, 1.3 mg/l. Presence of the chelator EDTA in medium had no effect on toxicity of carbaryl to S. costatum, Nitzschia angularum, Chlorococcum sp. and Chlorella sp. Liquid industrial wastes either stimulated growth, inhibited growth, or stimulated growth at low concentrations but inhibited it at higher concentrations. In mixed-species studies with the herbicide neburon, presence of a resistant species protected the sensitive species. Liquid industrial waste from a paper products plant caused changes in relative numbers, as compared to controls, when S. costatum and Porphyridium cruentum were grown together. (Deal-EIS)
W80-04740

CHLOROTIC DEATH OF LEMNA GIBBA BY CADMIUM IN DIFFERENT CONCENTRATIONS OF NUTRITIONAL MINERALS (IN JAPANESE),
Tokyo Univ. of Agriculture and Technology (Japan). Faculty of Agriculture.
M. Seto, Y. Takahashi, T. Ushijima, and T. Tazaki.
The Japanese Journal of Limnology, Vol 40, No 2, p 61-65, 1979. 6 Fig, 2 Tab, 12 Ref. (English Abstract).

Descriptors: *Cadmium, *Trace elements, *Mortality, *Aquatic plants, Plant physiology, Plant pathology, Proteins, Nutrient requirements, Water chemistry, Growth rates, Chemical analysis, *Lemna, *Tissue analysis.

The green frond of Lemna gibba turned into a chlorotic one and always died when cultured in a medium containing cadmium. The ratio of chlorotic fronds to total fronds was greatly affected by the difference in concentration of nutritional minerals even when the concentrations of cadmium in the medium were the same. The cadmium contents of L. gibba were also affected by the difference in concentration of nutritional minerals. The appearance of chlorotic frond was not explicable from the cadmium contents of L. gibba. When cultured in a high concentration of nutritional minerals, the chlorotic frond did not appear in spite of the high content of cadmium in the frond. On the other hand, when cultured in a low concentration of nutritional minerals, the chlorotic frond appeared in spite of the low content of cadmium in the frond. The protein content of L. gibba was changed considerably by the difference in concentration of nutritional minerals. This change in protein content might be related to differences in the

appearance of the chlorotic frond. To study the effect of a pollutant on an organisms, it will be necessary to understand the effect of an environmental condition on an organism as well as the amount of a pollutant accumulated by an organism. (Deal-EIS)
W80-04742

HEAT PUMP UPDATE,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5B.
W80-04745

BACTERIA: WHAT ARE THEY,
National Water Well Association, Worthington, OH.
S. Smith.
Water Well Journal, Vol 34, No 2, p 60-61, February, 1980.

Descriptors: *Bacteria, *Disinfection, Autoclaves, Digestion, E-coli, Iron bacteria, Soil bacteria, Sulfur bacteria, Speciation, Adaptation.

Bacteria are the simplest forms of self-sufficient organisms. Their structural simplicity enables them to reproduce quickly and create more resistant strains in response to chemical treatment. Some species form hard or gelatinous shells to withstand boiling water. Anaerobic bacteria can live without oxygen. Autoclaving (pressure cooking) at 121C and 15 psi for twenty minutes is the only sterilization technique that is 100 percent effective in destroying bacteria. But, where situations prohibit autoclaving, other techniques such as chlorination will suffice. Most bacteria are harmless or beneficial. E-coli bacteria helps us digest food. Soil bacteria digest dead plant and animal matter. This process is used in sewage treatment plants to make the effluent fit for further treatment. Harmful bacteria are those which cause discomfort and inconvenience to humans. Iron and sulfate-reducing bacteria are a nuisance but do not present a health hazard. (Purdin-NWWA)
W80-04748

5B. Sources Of Pollution

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: III. A CONCEPTUAL MODEL FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. Khaleel, G. R. Foster, K. R. Reddy, M. R. Overcash, and P. W. Westerman.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1353-1361, November-December 1979. 1 Fig, 3 Tab, 46 Ref, 3 Append. EPA R-805011-01-0.

Descriptors: *Water pollution sources, *Sediments, *Farm wastes, *Model studies, Mathematical models, Pollutants, Chemicals, Nitrogen, Phosphorus, Pesticides, Sediment transport, Erosion, Soil erosion, Rill erosion, Agricultural runoff, Agricultural watersheds, Agriculture, Hydrology, Nonpoint water pollution sources.

Some chemical pollutants are adsorbed to soil particles and transported with the sediment load. Sediments contain a mixture of particles of varying sizes and densities that have differing transport characteristics and affinities for chemical pollutants. In addition, manure particles are detached and transported by erosion processes during runoff events. A mathematical model was presented that describes the transport of various sediment particle types during unsteady overland-flow from manured areas. The present version of the model considers transport of four discrete particle fractions--fine primary, coarse primary, soil-aggregate, and manure particles. Sediment originates from two sources--interrill areas and rill areas. Two manure application modes, surface-applied or soil-incorporated, are recognized. The model operates with existing watershed hydrologic models and can be useful in studies of nonpoint source pollution from land areas receiving animal wastes. (Sims-ISWS)
W80-04515

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: IV. MODEL INPUTS AND VERIFICATION FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. Khaleel, G. R. Foster, K. R. Reddy, M. R. Overcash, and P. W. Westerman.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1362-1368, November-December 1979. 3 Fig, 8 Tab, 22 Ref. EPA R-805011-01-0.

Descriptors: *Water pollution sources, *Sediments, *Farm wastes, *Model studies, Mathematical models, Watersheds(Basins), On-site data collections, Erosion, Soil erosion, Rill erosion, Sediment transport, Suspended solids, Bed load, Runoff, Storm runoff, Agricultural watersheds, Agricultural runoff, Agriculture, Hydrology, Water pollution, Nonpoint water pollution sources.

A mathematical model describing transport of sediment and manure during unsteady overland flow from land areas receiving animal wastes was presented in a previous paper. Results of a comprehensive literature survey characterizing model inputs due to manure presence were presented in this paper. Inputs were: manure cover on the watershed, manure erodibility factor, and manure particle-size distribution and particle density. Estimated sediment yields were compared with measured data for selected storms on a 1.1-ha pasture watershed near Coshocton, OH. The simulated results agreed reasonably well with these field data. (Sims-ISWS)
W80-04516

EFFECTS OF SLASH BURIAL ON STREAM WATER QUALITY,
Washington Univ., Seattle. Coll. of Forest Resources.
A. G. Larson, and D. D. Wooldridge.
Journal of Environmental Quality, Vol 9, No 1, p 18-20, January-March 1980. 1 Tab, 14 Ref.

Descriptors: *Forestry, *Water quality, *Waste disposal, *Wood wastes, Forest management, On-site investigations, Sampling, Chemicals, Electrical conductance, Ions, Hydrogen ion concentration, Dissolved oxygen, Streams, Water chemistry, Chemical analysis, Data processing, Forests, Pollutants, Water pollution, Water pollution sources, Logging residue, Slash burial.

A 3-year study investigated impacts of buried logging residue on stream water composition. Burying of logging slash has been proposed as an alternative to burning. Residue was buried in trenches adjacent to two small ephemeral streams; one trench was filled with approximately 180 cu m of logging slash, the other with 94 cu m of mill residue. Streamflow was diverted to flow through the burial pits. Stream water samples collected from above (pretreatment) and below (post-treatment) the burial sites were analyzed for dissolved oxygen, pH, electrical conductance, alkalinity, temperature, K, Na, Ca, Mg, Fe, N03-N, NH4-N, S04-S, P04-P, total N, and total P. Changes in chemical composition occurring between pre- and post-treatment sampling sites were tested for significance using a paired sample t-test. With the exception of dissolved oxygen, surface water degradation resulting from burial was of no practical importance. Many ions decreased in concentration as waters passed through buried residue. Statistical comparisons of pre- and post-treatment water composition indicate significant increases were limited to H; pH decreased from 6.56 to 6.42 as a result of the buried slash. Oxygen depletion may be the most serious burial effect, with mean concentrations in the buried slash stream decreasing from 10 to approximately 8 mg/liter, a drop in oxygen saturation from 93 to 71%. (Sims-ISWS)
W80-04517

TRIFLURALIN MOVEMENT IN RUNOFF FROM A SMALL AGRICULTURAL WATERSHED,
Science and Education Administration, Tifton, GA.
W. A. Rohde, L. E. Asmussen, E. W. Hauser, R. D. Wauchope, and H. D. Allison.
Journal of Environmental Quality, Vol 9, No 1, p 37-42, January-March 1980. 4 Fig, 5 Tab, 16 Ref.

Descriptors: *Herbicides, *Runoff, *Watersheds(Basins), *Georgia, Sampling, Chemical analysis, Pesticides, Agricultural chemicals, Agricultural runoff, Grassed waterways, Agricultural watersheds, Rainfall, Simulated rainfall, Farm management, Agriculture, Water pollution, Path of pollutants, Trifluralin.

Little trifluralin moved in the surface flow from a small agricultural watershed located in the Southeastern Coastal Plain. Movement of trifluralin in 1974 and 1975 in surface water was 0.17 and 0.03%, respectively, of the total amount applied (1.12 kg/ha). Trifluralin movement in the shallow subsurface flow (above the 214 cm depth) was recorded only in 1974 and was negligible. Trifluralin was detectable in the soil from the 1974 application before the 1975 application. Soil concentration of trifluralin in 1974 was 320 ng/g (immediately after application) in the 0- to 10-cm depth and after 114 days the concentration decreased to 73 ng/g. However, no trifluralin was detected in the 30- to 60-cm depth 60 days after application. Simulated surface runoff from subplots on the watershed produced measurable concentrations of trifluralin 38 days after application, but it could not be detected after 71 days. Trifluralin movement was greater in runoff caused by simulated rainfall than that from natural rainfall due to the high application rate of water (19.1 cm/hour) and the lack of a vegetational buffer. Trifluralin loss in the simulated rainfall runoff water from a small plot directed through a 24.4-m waterway was reduced 96% under dry and 86% under wet conditions. Hence, trifluralin movement can be significantly reduced and possibly managed by buffer strips or vegetated waterways adjoining cropped areas. Appropriate use of these buffer areas should reduce to acceptable levels the chemical concentration in the runoff before the runoff reaches the surrounding streams. (Sims-ISWS)
W80-04518

EFFECTS OF WOOD PRODUCTS HARVEST ON FOREST SOIL AND WATER RELATIONS,
Northeastern Forest Experiment Station, Parsons, WV. Timber and Watershed Lab.
For primary bibliographic entry see Field 4C.
W80-04519

FERTILIZER NUTRIENT LOSSES FROM RANGELAND WATERSHEDS IN CENTRAL OKLAHOMA,
Science and Education Administration, Durant, OK.
A. Olness, E. D. Rhoades, S. J. Smith, and R. G. Menzel.
Journal of Environmental Quality, Vol 9, No 1, p 81-86, January-March 1980. 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Range management, *Fertilizers, *Grazing, *Nutrient removal, *Oklahoma, Ranges, Watersheds(Basins), Rainfall, Runoff, Nutrients, Nitrogen, Phosphorus, Water quality, Erosion, Vegetation effects, Grasslands, Grasses, Range grasses.

Four native grassland watersheds were monitored for nitrogen and phosphorus nutrient losses in surface runoff. The watersheds, paired in surface hydrology and grazing management, were 8 to 11 ha in area with 3% slopes. One watershed of each pair was fertilized with 85 kg N/ha (as NH4(+)-N) and 75 kg P/ha surface broadcast. Ten 3.66 by 5.49 m (20 sq m) areas within each watershed were covered with plastic sheets during fertilization to provide unfertilized check plots. Fertilizer losses in surface runoff over the first year were 5% or less of the amounts applied. Soluble NH4(+)-N concentrations in surface runoff increased significantly only during the first month after fertilizer application. Soluble P concentrations incrased sharply after fertilization and remained relatively high even after 12 mo. Forage yields were increased 50

to 100% on fertilized areas. Increases in nutrient uptake of fertilized vegetation the first year equaled 17 to 25.5 kg/ha and 7.5 to 11 kg/ha of the added N and P, respectively. (Sims-ISWS)
W80-04520

PRECIPITATION ACIDITY: THE ROLE OF THE FOREST CANOPY IN ACID EXCHANGE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2K.
W80-04521

PHOSPHORUS VARIATIONS IN SURFACE RUNOFF FROM AGRICULTURAL LANDS AS A FUNCTION OF LAND USE,
Wisconsin Univ.-Madison. Dept. of Soil Science.
R. C. Wendt, and R. B. Corey.
Journal of Environmental Quality, Vol 9, No 1, p 130-136, January-March 1980. 8 Tab, 29 Ref.

Descriptors: *Phosphorus, *Agricultural runoff, *Nutrient removal, *Land use, Algae, Nutrients, Runoff, Water pollution, Water pollution sources, Eutrophication, Fertilizers, Farm wastes, Sediments, Infiltration, Crops, Forests, Agriculture, Nonpoint water pollution sources.

Phosphorus (P) carried in surface runoff from agricultural lands can be a major source of algal-available P in surface waters. The available P may include both dissolved and some fraction of the sediment-bound forms. In this study the effects of land use, time of year, and application of animal manure on several forms of P in runoff from farmed and forested lands were investigated. Simulated rain was used to generate runoff. Losses of dissolved molybdate-reactive P (DMRP), the majority of which is dissolved orthophosphate, were greatest from established or newly seeded alfalfa fields (Medicago sativa L.) in the fall after the foliage had been killed by frost. The fraction of total P lost as DMRP was greater for alfalfa than for corn (Zea mays L.) or a conventionally prepared seedbed. Greatest total P losses were from corn and seedbed areas due to greater sediment losses. Phosphorus potentially available to algae was estimated by extraction with hydroxy-aluminum resin. Amounts extracted were equal to DMRP plus an average of 17 and 34% of the remaining total P for samples with and without apparent sediment, respectively. Greatest losses were associated with highest sediment loads. Surface-applied manure on corn and alfalfa increased P concentrations in runoff but, due to increased infiltration, did not significantly increase P losses. Loss of P from forest land was less than from crop land. (Sims-ISWS)
W80-04523

PERSISTENCE OF FLURIDONE IN SMALL PONDS,
Fisheries and Marine Service, Winnipeg (Manitoba). Dept. of Fisheries and Ocean.
D. C. G. Muir, N. P. Grift, A. P. Blouw, and W. L. Lockhart.
Journal of Environmental Quality, Vol 9, No 1, p 151-156, January-March 1980. 4 Fig, 5 Tab, 15 Ref.

Descriptors: *Herbicides, *Ponds, *Persistence, Aquatic weeds, Aquatic weed control, Water pollution, Pollutants, On-site investigations, Sampling, Sediments, Adsorption, Fish, Bioassay, Chemical degradation, Fluridone.

Fluridone was applied to three small ponds (5 by 3.5 sq m) to give water concentrations of 5,000, 700, and 70 micrograms/liter, respectively. Water, hydrosoil (0 to 3 and 3 to 6 cm depth), duckweed (Lemna minor), and minnows (Pimephales promelas) were collected for residue analysis over a 70-week period following herbicide application. The half-life of fluridone in the water column (0.5 m depth) ranged from 4 (at 700 micrograms/liter) to 7 days (70 micrograms/liter). Upon retreatment of one of the ponds the following year at 100 micrograms/liter, a half-life of 4 days was observed. Fluridone persisted in hydrosoils with an apparent half-life of 1 year or more at all treatment levels. Retreatment of one of the ponds resulted in a buildup of herbicide residue which dissipated more rapidly (half-life of 20 weeks) than after the first treatment. Bioassays indicated that fluridone residues in hydrosoil from the ponds treated at 700 and 5,000 micrograms/liter, taken 42 to 70 weeks after treatment, were phytotoxic to duckweed. Fluridone levels in minnows were very low (less than 0.02 to 0.14 microgram/g) throughout the sampling period with bioconcentration factors ranging from 0 to 64. Fluridone levels in duckweed were proportional to the herbicide concentrations in the pond water with bioconcentration factors ranging from 19 to 85. (Sims-ISWS)
W80-04524

A COMPARISON OF COMPOSITE SAMPLING TECHNIQUES FOR MONITORING RUNOFF,
Wisconsin Univ.-Madison. Dept. of Soil Science.
T. C. Daniel, R. C. Wendt, P. E. McGuire, and D. Stoffel.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1310-1312, November-December 1979. 2 Fig, 1 Tab, 6 Ref. EPA G005139-01.

Descriptors: *Runoff, *Pollutants, *Sampling, *Monitoring, Data processing, Analytical techniques, Pollutant identification, Suspended solids, Nitrogen, Phosphorus, Nutrients, Water pollution sources, Agricultural runoff, Agriculture.

The technical feasibility of using a flow proportional composite sample for determining event loads was evaluated using runoff data from an ongoing watershed investigation. For the same event, loads were calculated and compared using the following methods: (1) discrete event load (DEL), (2) composite event load (CEL), and (3) three sample mean event load (SMEL). The DEL method is based on standard integration techniques using the concentration of individual discrete samples taken at preselected runoff intervals (proportional to flow). The CEL procedure utilizes the concentration of a flow proportional composite sample in combination with total volume of runoff, whereas the SMEL method uses the mean concentration of three selected samples taken on the basis of time into the event. DEL data were assumed to be true value and serve as a basis of comparison for the CEL and SMEL procedures. A highly significant correlation was shown to exist between the DEL and the CEL and SMEL methods for all parameters analyzed, i.e., suspended solids (SS) and nitrogen and phosphorus components. Slopes and intercepts of each method for all parameters approached one and zero, respectively. No significant difference between the CEL and SMEL methods was detected, although there appeared to be a tendency for the SMEL method to overestimate the loads of SS and associated parameters for large events. Both the CEL and SMEL methods are technically sound and result in considerable savings in analysis cost. The advantages of the CEL over the SMEL method, especially for new monitoring programs, are that additional savings in analysis cost can be realized along with the elimination of considerable amounts of hand labor. (Sims-ISWS)
W80-04525

IMPACT OF UNCONFINED LIVESTOCK ACTIVITIES ON WATER QUALITY,
Louisiana Tech Univ., Ruston. Dept. of Agricultural Engineering.
J. W. D. Robbins.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1317-1323, November-December 1979. 8 Tab, 32 Ref. EPA R804497.

Descriptors: *Water quality, *Pastures, *Livestock, *Agricultural runoff, Effects, Water pollution sources, Erosion, Sedimentation, Farm management, Land use, Pollutants, Path of pollutants, Coliforms, Biochemical oxygen demand, Nitrogen, Phosphorus, Agriculture, Reviews, Unconfined livestock impact.

Current knowledge related to environmental effects of grazing animals was presented. All available data indicate that pollutant yields from pasture and rangeland operations are not directly related to the number of animals or amount of wastes involved. Rather, they are intimately related to hydrogeological and management factors and are best described as the results of the erosion/sediment phenomenon. (Sims-ISWS)
W80-04526

MIXING PROCESSES ON THE ATLANTIC CONTINENTAL SHELF, CAPE COD TO CAPE HATTERAS,
California Univ., Berkeley. Dept. of Civil Engineering.
H. B. Fischer.
Limnology and Oceanography, Vol 25, No 1, p 114-125, January 1980. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Mixing, *Circulation, *Continental shelf, *Atlantic Ocean, Water circulation, Ocean circulation, Dispersion, Water pollution, Currents(Water), Ocean currents, Water temperature, Sewage, Coliforms, Bacteria, Path of pollutants, Current meters, Aerial photography, Oceanography, *Middle Atlantic Bight.

Data from moored current meters and airborne and satellite observations were used in conjunction with analyses of shear flow dispersion to estimate the dispersion of dissolved substances in the Middle Atlantic Bight during unstratified periods. The long-shelf dispersion coefficient was estimated to be of the order of 10,000-100,000 sq cm/s, and the cross-shelf dispersion coefficient of the order of 300,000 sq cm/s at midshelf. The cross-shelf estimate was a factor of 10 less than previous ones, which were based on the assumption that the cross-shelf flux of freshwater is equal to the inflow from tributary rivers within the bight itself. (Sims-ISWS)
W80-04532

WATER-QUALITY CHARACTERISTICS OF STREAMS IN FORESTED AND RURAL AREAS OF NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
C. E. Simmons, and R. C. Heath.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149834, Price code: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-108, 1979. 49 p, 15 Fig, 6 Tab, 15 Ref.

Descriptors: *Water quality, *Streams, *Forests, *Rural areas, *North Carolina, Water pollution sources, Natural streams, High flow, Low flow, Environmental effects, Geochemistry, Baseline studies, Storm runoff, Chemical analysis, Evaluation.

Data collected in North Carolina during 1973-78 from a statewide network of 39 rural sampling sites were used to define unpolluted or baseline stream quality. The basins were 90 to 100 percent forested and, except for the unknown effects of air pollution, were relatively unaffected by man's activities. Five distinct geochemical zones were delineated across the State. The chemical characteristics of surface waters in each zone are similar. Mean and other statistical values for major dissolved constituents, nutrients, and minor elements in base runoff and storm runoff were determined. Twenty additional rural sites were located in basins where farming activities ranged from 15 to 55 percent of basins' land area. Data from these 20 sites were used for comparison with data from the 39 unpolluted sites to determine the increase in constituent levels caused by man. For basins where farming activities accounted for 20 or more percent of total land use, phosphorus levels were 2 to 13 times greater than those from the forested basins and several major constituents were 2 to 3 times greater. Concentrations of minor elements were essentially the same in both developed and undeveloped basins. (Kosco-USGS)
W80-04558

ENVIRONMENTAL LAW (RESOURCE UTILIZATION, WATER POLLUTION AND AIR POLLUTION),

V 13/14 JL 15 80 UMI

For primary bibliographic entry see Field 6E.
W80-04582

SOLUBILITY OF SELECTED MAJOR AND MINOR ELEMENTS FROM COAL, GOB AND FLY ASH ACCUMULATIONS,
Kansas Water Resources Research Inst., Manhattan.
D. A. Kopsick, and E. E. Angino.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175334, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, March 1980. p 26, 10 Fig, 2 Tab. OWRT-A-087-KAN(1).

Descriptors: *Coals, *Water pollution, *Leachates, *Groundwater, *Fly ash, Leaching, Ion transport, Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Zinc, Copper, Lead, Cadmium.

Nine different fly and bottom ashes, representing four coal producing areas of the United States were used in leaching experiments for Ca, Mg, Na, K, Fe, Mn, Zn, Cu, Pb, and Cd and the potential for contamination of ground and surface water supplied by these elements. Both fly ash and bottom ash are formed by the thermal decomposition or dehydration of inorganic impurities in coal and vary with the type of coal used. Many factors affect leachate characteristics such as coal preparation methods, method and efficiency of combustion, method of disposal, particle morphology, and others. Glass columns 2 ft in length, 2 in in diameter, and packed with 18 in of sample were used to study the leachates. Distilled, deionized water was used as the leaching solution. Three leaching patterns were observed: (1) a hyperbolic curve with a large initial flush of elements followed by leveling off, (2) a constant release especially for calcium, and (3) a delay in time before maximum release concentration. Missouri coal leachate was rich in Pb, Zn, Cu, Fe, Mn, and Cd. This richness combined with a pH of 3.0 gives the Missouri coal the greatest potential for groundwater contamination. Low trace metal concentrations were observed for Wyoming fly and bottom ashes, but they were high in K, Na, Ca, and Mg. Kentucky and Illionis coals gave intermediate results. (Seigler-IPA)
W80-04604

PUBLIC HEALTH ASPECTS OF LAND DISPOSAL OF SUGAR REFINING WASTES BY SPRAY IRRIGATION,
North Dakota State Univ., Fargo. Dept. of Bacteriology.
B. R. Funke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175359, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University Research Project Technical Completion Report, October 1979. p 9. OWRT A-057-NDAK(1).

Descriptors: *Salmonella, *Sprinkler irrigation, *Sugar beets, *Public health, Coliforms, Waste water disposal, Soil microbiology, Irrigation practices, Irrigation water, Water resue, Irrigated land, Alfalfa, Agriculture, Bacteria.

The potential of a public health hazard caused by the spray irrigation disposal of sugar beet processing wastes contaminated with Salmonella bacteria was investigated at the Hillsboro, North Dakota plant of the American Crystal Sugar Company. Incoming sugar beets are washed, sliced, and processed for sugar extraction. At times all water used is not recycled and lime-mud waters are pumped into an irrigation lagoon and disposed of by spray irrigation. Most-probable-number methods using selective and differential media were used to enumerate the bacteria from various locations in the processing sequence and in the disposal lagoons used. Fecal coliforms were also enumerated by standard methods. Results show that the processing water of the plant often had large populations of both Salmonella and fecal coliform bacteria. Salmonella were found in the irrigation lagoon at some times during the year but not during the warmer months when spraying was done. No Salmonella were found in the soil sprayed with the lagoon water. The source of Salmonella at the plant was found to be the tare soil on the incoming beets. The soil was also the source of the fecal coliforms. However, neither fecal coliforms or Salmonella were found in beet field soils and farmers denied using animal wastes as fertilizer in the fields. The study does not indicate any public health problems as a result of spray irrigation disposal of the sugar beet processing wastes. (Seigler-IPA)
W80-04608

EFFECT OF CLIMATE AND TEMPERATURE ON THE AMOUNT OF HC03(-) AND H2C03 OF GROUNDWATERS (INFLUENCE DU CLIMAT, DE LA TEMPERATURE SUR LA TENEUR EN HC03(-) ET H2C03 DES EAUX SOUTERRAINES),
For primary bibliographic entry see Field 2F.
W80-04623

CHEMICAL TRACERS FOR PARTICLE TRANSPORT IN THE CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
A. Eaton, V. Grant, and M. G. Gross.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 75-83, January 1980. 4 Fig, 2 Tab, 31 Ref. DOE EY76-S02-3292.

Descriptors: *Suspended solids, *Turbidity, *Sediment transport, *Tracers, *Chesapeake Bay, Trace elements, Pollutants, Nutrients, Metals, Iron, Titanium, Zinc, Sampling, Chemical analysis, Rivers, Water pollution, Water pollution sources, Estuaries, *Susquehanna River(MD).

Particulate material from the Susquehanna River is enriched in Fe (5-7%), allowing it to be distinguished from other sources of particles in surface waters of the Chesapeake Bay. Although the turbidity maximum removes most of the river-borne detritus, chemical composition of suspended particle matter (SPM) indicates that Susquehanna River materials dominate the inorganic suspended matter in surface waters of the Bay at least 20-40 km further. Fe concentrations, Fe/Ti, and Fe/Zn ratios in surface water SPM still farther down the Bay indicate that those particles are a mixture of river derived and biological material and that shore erosion is not normally a source of surface water suspended sediments as far as the mouth of the Potomac. Seasonal variations of elemental ratios such as Fe/Zn can also be used to demonstrate scavenging of soluble trace elements by particles during summer conditions. (Sims-ISWS)
W80-04632

CHLORIDE DISPLACEMENT BY WATER IN HOMOGENEOUS COLUMNS OF THREE SOILS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2G.
W80-04639

NITROGEN AND WATER DISTRIBUTIONS IN FERTILIZED SANDY SOIL DURING IRRIGATION AND DRAINAGE,
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W80-04642

TURBULENCE PREDICTION IN OPEN CHANNEL FLOW,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04645

CHLOROPHYLL TURNOVER IN SKELETONEMA COSTATUM, A MARINE PLANKTON DIATOM,
Brookhaven National Lab., Uptown, NY. Dept. of Energy and Environment.
D. M. Riper, T. G. Owens, and P. G. Falkowski.
Plant Physiology, Vol 64, No 1, p 49-54, July 1979. 7 Fig, 1 Tab, 17 Ref. EY-76-C-02-0016.

Descriptors: *Skeletonema costatum, *Chlorophyll, *Marine plants, *Tracking techniques, Diatoms, Chlorophyll-a, Chlorophyllide-c, Plankton, Tracers, Radioisotopes, Cytological studies, Aminolevulinic acids(ALA), Dye dispersion, Radioactivity techniques, Photosynthesis.

Radioactively-labeled Aminolevulinic acids (ALA) were incorporated into the chlorophylls of Skeletonema costatum, a marine plankton diatom. It was noted that normal cells of S. costatum took up significant extracellular ALA, even though they were originally thought to be impermeable to primary amino acids. Up to 2% of the total ALA uptake was incorporated into chlorophyll-a and chlorophyllide-c. Radioactive ALA was not directly incorporated into carotenoid or xantophyll pigments. The addition of 0.5 micro mole ALA to the culture media did not alter the rates of cell division of chlorophyll-a and chlorophyllide-c accumulation from those of untreated cells. Pigment specific activity of chlorophyllide-c was greater than that of chlorophyll-a. The incorporation of radioactive ALA into chlorophyll-a and chlorophyllide-c pools in stationary cultures of S. costatum was rapid and reached equilibrium after 10 hours. Cells which have been exposed to radioactive ALA for 48 hours and had attained a density of one million cells/ml were resuspended in fresh media at a density of 300,000 cells/ml. Complete dilution of the labeled pigment pools was not observed. The initial rapid loss of label was followed by a period of little or no loss and a specific activity of the pool of about 30% of the maximum attained before the resuspension. Beyond 15 hours the pigment pools showed a trend of increased labeling. The dilution of chlorophyll-a and chlorophyllide-c pools labeled with ALA hydrogen and carbon isotopes indicated that C14 incorporation began 20 hours after the resuspension, and was accompanied by slight increase in H3 labeling. (Harris-Wisconsin)
W80-04659

THE RIVER LAXA ECOSYSTEM, ICELAND,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
For primary bibliographic entry see Field 2E.
W80-04663

COMPARATIVE CARBOHYDRATE STORAGE AND UTILIZATION PATTERNS IN THE SUBMERSED MACROPHYTES, MYRIOPHYLLUM SPICATUM AND VALLISNERIA AMERICANA,
Wisconsin Univ.-Madison. Dept. of Botany.
J. E. Titus, and M. S. Adams.
The American Midland Naturalist, Vol 102, No 2, p 263-272, October 1979. 3 Fig, 1 Tab, 35 Ref. NSF DEB-19-777; AG 40-193-69.

Descriptors: *Carbohydrates, *Nutrient requirements, *Myriophyllum spicatum, *Vallisneria americana, *Plant growth regulators, Lake Wingra(WI), Submerged plants, Aquatic weed control, Nuisance algae, Biomass, Seasonal, Rooted aquatic plants, Metabolism, Productivity, Macrophytes, Growth rates.

The hypothesis that ample storage of total nonstructural carbohydrates (TNC) by Vallisneria americana could support a growth flush to compensate for its short growing season was tested by the analysis and comparison of plant tissues of Myriophyllum spicatum and Vallisneria americana. Myriophyllum and Vallisneria plants were collected at four stations on Lake Wingra, Madison, Wisconsin. Sampling was conducted during annual cycles in 1974 and 1975. The sampling methods were designed in such a manner that it was possible to quantify shoot/root ratios. Both species exhibited marked seasonal patterns in percentages of TNC in above and below-sediment plant parts. Mean TNC values in M. spicatum ranged from 1.6-19.0% for roots and 2.0-20.0% for shoots. The low values were associated with the spring growth flush. V. americana tissues ranged from 4.0-28.0% TNC during the growing season, while winter bud TNC values were 45%. However, since the winter

biomass was quantitatively low, the total winter reserves of V. americana community were inadequate to permit compensation for a late start in spring. Thus, the proposed hypothesis that ample storage of TNC by V. americana could support a growth flush to compensate for its short growing season was rejected. (Harris-Wisconsin)
W80-04665

PREVENT GROUND WATER CONTAMINATION BEFORE IT'S TOO LATE,
Camp, Dresser and McKee, Boston, MA.

Water and Wastes Engineering, Vol. 17, No. 2, p 30-33, 63, February, 1980. 2 Fig, 2 Tab.

Descriptors: *Groundwater, *Water pollution control, *Organic wastes, *Public health, *Water pollution sources, *Water pollution treatment, Carcinogens, Toxicity, Septic tanks, Landfills, Leachate, Leakage, Sewerage, Storage tanks, Waste disposal, Waste storage, Accidents, Aeration, Carbon filters, Resins, Adsorption, Oxidation, Biodegradation, Costs.

The use of ground water for both water supply and waste disposal often results in contamination from toxic compounds. Little attenuation of these organic contaminants occurs in aquifers. The effects of toxic chemicals on human health are debatable but safe levels must be established. A preliminary list of 13 carcinogens published by the EPA shows cancer risk increases with increasing contaminant levels. Also shown are the maximum noncarcinogenic levels for various lengths of exposure. Over the past 12 to 15 months more than 25 Massachusetts municipal water supplies and numerous private wells have been contaminated by organics. Contaminant sources included: septic systems, landfill leachate, sewer system leaks, storage tank leaks, industrial waste lagoons, accidental spills, and illegal disposals. Aquifer decontamination requires a considerable amount of time and expense. Methods for removal of organics include aeration, carbon adsorption, synthetic resin adsorption, oxidation, and biodegration. A combination of processes is the most effective approach. The cost of this treatment will greatly exceed the cost of surface water treatment. Future organic contamination should be prevented by establishing aquifer protection zones, managing septic systems, repairing sewer system leaks, controlling major chemical discharges, and regulating the construction and testing of storage tanks. (Purdin-NWWA)
W80-04666

QUANTIFICATION OF NON-POINT WATER POLLUTANTS FROM LOGGING, CATTLE GRAZING, MINING, AND SUBDIVISION ACTIVITIES,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W80-04669

AN ENVIRONMENTAL STUDY OF THE ORIGIN, DISTRIBUTION, AND BIOACCUMULATION OF SELENIUM IN KENTUCKY AND BARKLEY LAKES,
Kentucky Water Resources Research Inst., Lexington.
B. E. McClellan, and K. J. Frazer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176118, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 122, 1980. 44 p, 11 Fig, 5 Tab, 6 Ref. OWRT A-075-KY(1), 14-34-0001-8019, 14-34-0001-9019.

Descriptors: *Trace elements, Deposition(Sediments), Water quality, Chemical analysis, *Lakes, *Streams, *Sediments, *Fish, Kentucky, Tennessee, Atomic absorption spectrometry, Bioaccumulation.

Samples of water, bottom sediment, and fish were analyzed for toxic metal ion content. The samples were collected from several selected sites along Kentucky and Barkley Lakes as well as the Cumberland River and several sub-impoundments along these aquatic systems. Emphasis was placed on selenium, although several other metal ions were determined. The results showed that there are no serious pollution problems with As, Cd, Cr, Cu, Hg, Pb, Se, Sr, Zn, or Zr at any of the sites examined. Actually, none of the trace metals examined even come close to the EPA limits on fish, with the exception of lead in the White Crappie and mercury in the Bass. There appears to be no serious problem with lead in White Crappie as only two fish out of a total of nineteen were above the limit of 2 PPM. The same holds for mercury in the bass as only three fish out of thirty-four were above the 0.5 PPM level. Water and sediment analyses for the above mentioned metal ions fell well within expected 'normal' limits for unpolluted fresh water systems. No point sources could be identified for any of the metal ions. This is in contrast with results obtained on the lower Tennessee River by Hancock, et al, in which a large chemical complex was found to contribute significant quantities of trace metals. No significant seasonal variation of trace element content was observed in any of the sample types. Since the selenium content of all samples was so low, no laboratory bioaccumulation data were obtained. No general correlation between fish length and trace element content could be established.
W80-04672

DESK TOP METHODOLOGY FOR MODELING BIOCHEMICAL OXYGEN DEMAND IN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 7B.
W80-04673

ACCUMULATION OF 210PB IN FRESHWATER PLANTS,
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany.
D. P. Marchyulenene, R. F. Dushauskene-Duzh, E. B. Moteyunene, V. B. Nyanishkene, and G. G. Polikarpov.
Hydrobiological Journal, Vol 14, No 6, p 73-77, 1978. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Lead, *Adsorption, *Aquatic plants, Absorption, Heavy metals, Lead radioisotopes, Physicochemical properties, Water chemistry, Hydrogen ion concentration, Plant physiology, Plant pathology, Mode of action, Membrane processes, *Bioaccumulation, *Tissue analysis.

The uptake of 210Pb by aquatic plants take place mainly by adsorption on the cell walls. The accumulation rate of 210Pb is determined by its physicochemical state in the water, pH and communicative properties of cell walls. It also depends on Ca concentration in the water, the strength of its adsorption on cell walls, and the amount of stable lead in the plants and bottom sediments. In investigating the toxic effect of lead on Nitellopsis obtusa it was found that lead in a concentration of 0.5 mg/liter causes a lowering of protoplasm movement rate and partial destruction of cells and rhizoids. At concentration of 20.7 mg/liter, all cells and rhizoids die. (Deal-EIS)
W80-04692

STUDIES ON THE BINDING OF HEAVY METALS TO ALGAL POLYSACCHARIDES FROM PHILIPPINE SEAWEEDS. I. CARRAGEENAN AND THE BINDING OF LEAD AND CADMIUM,
Philippines Univ., Diliman, Quezon City. Marine Sciences Center.
R. L. Veroy, N. Montano, L. B. de Guzman, E. C. Laserna, and G. J. B. Cajipe.
Botanica Marina, Vol 23, p 59-62, 1980. 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Heavy metals, *Absorption, *Marine algae, Effects, Cadmium, Lead, Path of pollutants, Chemical analysis, Spectrophotometry, Metabolism, Biochemistry, Sulfates, *Seaweeds, *Carrageenan.

The metal-binding properties of the sulfated polysaccharides k- and l-carrageenan from Eucheuma striatum and Eucheuma spinosum are investigated by dialysing solutions of carrageenan against solutions of lead and cadmium salts. Alternatively, solutions of these metal cations are eluted through a column of the coarsely ground alga. The amounts of lead and cadmium bound by the polysaccharide are determined by atomic absorption spectrophotometry. Carrageenan is found to effectively bind both heavy metals, exhibiting a greater, though not significantly pronounced, affinity for lead. Metal binding capacity is correlated with the degree of sulfation of the carrageenan molecule. (Deal-EIS)
W80-04694

THE EFFECTS OF MERCURY EXPOSURE ON INTRACELLULAR DISTRIBUTION OF MERCURY, COPPER AND ZINC IN SKELETONEMA COSTATUM (GREV.) CLEVE,
British Columbia Univ., Vancouver. Dept. of Oceanography.
L. Cloutier-Mantha, and D. A. Brown.
Botanica Marina, Vol 23, p 53-58, 1980. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Mercury, *Copper, *Zinc, *Diatoms, Bioassay, Absorption, Metabolism, Path of pollutants, Heavy metals, Growth rates, Inhibition, Toxicity, Mode of action, Biochemistry, Mode of action, *Skeletonema.

The effects of exposure to low concentrations of HgC12 on the intracellular levels of Cu, Zn and Hg in S. costatum grown in artificial seawater were determined. An attempt was made to determine whether mercury-induced synthesis of metallothionein-like substance could be responsible for sequestering heavy metals in a diatom. Short-term exposure to 1.84 nM HgC12 resulted in a reduced growth rate and cell density, possibly due to the toxic effects of Hg which mainly accumulated in the high molecular weight pool. Pre-exposure to 1.84 nM HgC12 prior to exposure at 5.53 nM HgC12 resulted in a lower accumulation of Hg in the high m.w. pool. Exposure to 0.37 nM HgC12 was sufficient to alter the levels and distribution of intracellular Cu and Zn. Upon Hg exposure, Zn levels decreased in high and low m.w. fractions but gradually increased in the medium m.w. pool. Copper slightly increased in the high m.w. pool but remained constant in the medium and low m.w. pools in relation to total intracellular levels. The increase of Zn in the medium m.w. pool, in Hg-exposed cultures, the low levels of Cu and Zn in the medium m.w. fractions, and the absence of aromatic amino acids, suggest that metallothionein may play a role in storage or detoxification of heavy metals in S. costatum. High levels of Cu and Zn in the low m.w. pool may indicate that a substance of lower m.w. than usually reported for metallothionein-like substance also may play a role in the storage and detoxification of heavy metals in S. costatum. (Deal-EIS)
W80-04695

TISSUE METAL CONCENTRATIONS IN TWO CRAYFISH SPECIES COHABITING A TENNESSEE CAVE STREAM,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5A.
W80-04696

UPTAKE AND ELIMINATION OF ANTIMONY IN THE MUSSEL, MYTILUS EDULIS,
Institute fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5C.
W80-04697

THE EFFECTS OF HARDNESS, ALKALINITY AND PH OF TEST WATER ON THE TOXICITY OF COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Univ., Edmonton. Dept. of Zoology.
T. G. Miller, and W. C. Mackay.
Water Research, Vol 14, p 129-133, 1980. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Toxicity, *Copper, *Water chemistry, Rainbow trout, Hardness(Water), Alkalinity,

Hydrogen ion concentration, Lethal limit, Mortality, Chemical reactions, Chemical analysis, Mathematical models, Statistical analysis.

Rainbow trout were used to determine the effects of water alkalinity and hardness on the incipient lethal concentration (ILC) of copper. At low water hardness (12 ppm) the ILC of copper was not affected by a five-fold change in medium alkalinity (10-50 ppm); however in hardwater (98 ppm) the same change in alkalinity caused the ILC to increase by 1.8 times. The ILC for copper increased as hardness increased regardless of alkalinity. At pHs of less than 5.4 the toxicity of various combinations of copper and hydrogen ion were antagonistic but at pH 5.4 there appeared to be some synergism between pH and Cu toxicity. (Deal-EIS)
W80-04699

EFFECTS ON RAINBOW TROUT (SALMO GAIRDNERI) OF A CHRONIC EXPOSURE TO WATERBORNE SELENIUM,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Lab.
P. V. Hodson, D. J. Spry, and B. R. Blunt.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 233-240, 1980. 1 Fig, 5 Tab, 28 Ref.

Descriptors: *Toxicity, *Rainbow trout, *Metals, Lethal limit, Embryonic growth stage, Mortality, Mode of action, Fish eggs, Fish physiology, Monitoring, *Selenium, *Tissue analysis, *Bioaccumulation, *Blood chemistry.

The 96-h and 9-d LC50s of selenium for rainbow trout averaged 8.1 and 6.5 mg/l, respectively. A sublethal exposure of rainbow trout from the newly fertilized egg stage until 44 wk posthatch to 4.4-53 microg/l of waterborne selenium resulted in a variety of subtle responses. Significantly increased mortality of eyed eggs was observed at selenium concentrations greater than or equal to 28 microg/l and decreased red blood cell volumes and cellular blood iron at concentrations greater than or equal to 53 and 16 micro/l, respectively. Although the highest eyed egg mortality at 47 microg/l selenium was double that of control, total mortality was only 6.5%. Similarly, the blood parameters decreased from control levels by a maximum of 30% and the fish appeared to be compensating for these changes by increased erythropoiesis. Overall, the fish responded to selenium exposure at concentrations between 100 and 250 times the normal background concentrations in surface waters but the level of response was low. Analyses of tissue selenium at 44 wk posthatch indicated that residues clearly reflected exposure, that liver, digestive tract, and kidney accumulated the highest residues, that selenium tissue concentrations may be regulated, and that specific tissues provide a better basis for monitoring selenium exposure than whole body analyses. (Deal-EIS)
W80-04714

EFFECTS OF DIETARY ASCORBIC ACID ON CHRONIC LEAD TOXICITY TO YOUNG RAINBOW TROUT (SALMO GAIRDNERI),
Fisheries and Marine Service, Ottawa (Ontario). Great Lakes Biolimnology Lab.
For primary bibliographic entry see Field 5A.
W80-04720

THE STUDY OF EUTROPHICATION OF ALGAL BENTHOS BY ESSENTIAL METALS IN ARTIFICIAL RIVERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5A.
W80-04726

RESPIRATORY PROPERTIES OF ERYTHROCRUORIN (EXTRACELLULAR HEMOGLOBIN) IN THE BLOOD OF THE ANNELID ARENICOLA MARINA WITH SPECIAL REFERENCE TO THE INFLUENCES OF SALINITY AND TEMPERATURE,
Aarhus Univ. (Denmark). Dept. of Zoophysiology.
K. K. Rasmussen, and R. E. Weber.
Ophelia, Vol 18, No 2, p 151-170, 1979. 10 Fig, 1 Tab, 37 Ref.

Descriptors: *Annelids, *Respiration, *Salinity, *Water temperature, Animal physiology, Animal metabolism, Salt tolerance, Hydrogen ion concentration, Water chemistry, Oxygen, Carbon dioxide, *Acclimation, *Blood chemistry, *Hemoglobin, *Erythrocruorin.

Acclimation of Arenicola marina to high salinity increases the 02 affinity of the erythrocruorin in the blood compared to that in low-salinity acclimated animals. At pH 7.4 and 20C, the 02 tensions required for half-saturation (P50) are 2.1 and 3.3 mm Hg at water salinities of 32.3 and 10.2 o/oo, respectively. Acclimation salinity, however, does not appear to exert a consistent influence on the Bohr effect or the buffer capacity of the blood, although the buffer reserve is higher in low-than in high-salinity acclimated animals. The influence of temperature on the 02 affinity of the blood is small and appears to be independent of salinity. Acclimating batches of Arenicola to 6 and 18C, however, produced no evidence for thermo-acclimatory changes in blood 02 affinity. Curiously a specific effect of C02 (i.e. one which is not related to concomitant pH change) increases 02 affinity of the erythrocruorm rather than decreasing it as in vertebrate hemoglobin. The data are discussed as regards their possible adaptive significance to the worms in burrowing and intertidal habitats. (Deal-EIS)
W80-04728

SOME EFFECTS OF SALINITY AND TEMPERATURE ON THE OSMOTIC AND IONIC REGULATION OF PRAUNUS FLEXUOSUS (CRUSTACEA, MYSIDACEA) FROM ISEFJORD,
Stirling Univ. (Scotland). Dept. of Biology.
D. S. McLusky.
Ophelia, Vol 18, No 2, p 191-203, 1979. 3 Fig, 5 Tab, 30 Ref.

Descriptors: *Salinity, *Water temperature, *Toxicity, *Osmosis, Crustaceans, Membrane processes, Salt tolerance, Mortality, Sodium, Potassium, Calcium, Magnesium, Chlorides, Animal physiology, *Osmoregulation, *Acclimation, *Blood chemistry.

The salinity tolerance, osmotic regulation and ionic regulation of the mysid crustacean, Praunus flexuosus, collected at the Isefjord, Denmark, has been investigated over a range of salinities, and at temperatures from 5 to 20C for both winter and summer animals. Survival at low salinities was enhanced when the animals were kept at low temperatures, and this enhancement was especially pronounced in animals collected in winter. A clear pattern of hyper/hypo-osmotic regulation was found, but no effect of season or temperature on the osmotic concentration was observed. The blood concentration of Isefjord animals was significantly lower at any given salinity than that of previously studied animals from Loch Etive, Scotland. This reduction is considered to be due to long-term acclimation, and the findings are compared with other crustacea where studies have been made on distinct populations. The blood concentrations of sodium, potassium, calcium, magnesium and chloride were determined at three salinities, and found when totalled to account for the osmotic concentrations. (Deal-EIS)
W80-04729

OSMOTIC RESPONSES OF EGGS AND LARVAE OF THE PACIFIC HERRING TO SALINITY AND CADMIUM,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
D. F. Alderdice, T. R. Rao, and H. Rosenthal.
Helgolander wissenschaftliche Meeresuntersuchungen, Vol 32, p 508-538, 1979. 10 Fig, 11 Tab, 33 Ref.

Descriptors: *Cadmium, *Salinity, *Toxicity, *Herrings, Larval growth stage, Membrane processes, Osmosis, Fish eggs, Fish physiology, Mode of action, Heavy metals, Salt tolerance, Water chemistry, Pacific herring, *Osmoregulation.

Pacific herring (Clupea pallasi) eggs fertilized in 20 o/oo S and incubated in 5, 20 or 35 o/oo S at 5C, some being cross-transferred between 5 and 35 o/oo S, 61.8 hr after fertilization, showed variable yolk and perivitelline fluid (PVF) osmolalities until beginning of epiboly. Coincident with blastopore closure and for a period of ca. 150 hr thereafter (period of stability), both yolk and PVF osmoconcentrations were relatively constant. Thereafter osmolalities rose slowly to asymptotic levels prior to hatching. An hypothesis is presented whereby minimum osmotic work is defined on the basis of isosmotic relations existing between yolk, perivitelline fluid, and incubation medium. This leads to the description of a range of salinities defined in terms of osmoregulatory scope. The presence of a salinity-temperature interaction and its influence on the association between osmoregulatory scope and production of viable larvae is suggested as a mechanism underlying and providing the recognized plasticity of Pacific herring egg development. In a companion study involving cadmium as a contaminant, eggs incubated at 20 o/oo S were exposed to 0, 1 or 10 ppm Cd in 5, 20 or 35 o/oo S for 48-hr periods at six stages of development between fertilization and hatching. Cd exposure resulted in a reduction in osmolality of perivitelline fluid. Reduction was greater in higher Cd concentrations and in eggs transferred to higher salinities. (Deal-EIS)
W80-04733

LIVER CADMIUM UPTAKE, CATALASE INHIBITION AND CADMIUM THIONEIN PRODUCTION IN THE KILLIFISH (FUNDULUS HETEROCLITUS) INDUCED BY EXPERIMENTAL CADMIUM EXPOSURE,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
R. J. Pruell, and F. R. Engelhardt.
Marine Environmental Research, Vol 3, p 101-111, 1980. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Cadmium, *Toxicity, *Killifishes, Heavy metals, Inhibition, Enzymes, Biochemistry, Fish physiology, Animal metabolism, Copper, Chemical analysis, Mode of action, Bioassay, *Tissue analysis, *Bioaccumulation, *Liver.

Liver catalase activity was used as an index of cadmium poisoning in the killifish, Fundulus heteroclitus, and was found to be inhibited following both in vivo and in vitro exposure to dissolved cadmium at a concentration greater than 1 mg/litre. Pre-exposure at 1 mg Cd/litre prevented catalase inhibition at higher subsequent doses of cadmium. Comparison of the effects of in vivo and in vitro exposure showed in vivo exposure to cadmium to result in greater catalase inhibition. Cadmium and copper binding was determined by gel chromatography and found to occur at three distinct liver cytosol fraction peaks. Both metals showed enhanced cytosol concentrations with cadmium exposure and relative changes in peak levels as related to cadmium exposure regimes. Cadmium thionein (molecular weight of 7-10,000) was found in the killifish liver and was correlated with adaptive responses in liver catalase activity. High molecular weight cadmium binding was found to be a better index of cadmium toxicity to liver catalase than total liver cadmium concentration. (Deal-EIS)
W80-04738

HEAT PUMP UPDATE,
National Water Well Association, Worthington, OH.
D. Bacon.
Water Well Journal, Vol 34, No 2, p 37, February, 1980. 1 Fig.

Descriptors: *Heat pumps, *Environmental effects, *Computer models, On-site investigations, Effluents, Waste water disposal, Thermal pollution, Injection wells, Ground water.

The National Water Well Association and the University of Missouri, Rolla are examining the effects

of heat pump effluent injection on ground water temperature distribution and chemical equilibria. Hydrogeologic and climatologic data from a field site will be used to develop a computer model that will predict the nature and distribution of thermal plumes resulting from injection of heat pump discharge water under various conditions. This model will eventually predict the environmental impact resulting from high-density usage of ground water heat pumps. (Purdin-NWWA)
W80-04745

PREVENTING GROUNDWATER POLLUTION: TOWARDS A COORDINATED STRATEGY TO PROTECT CRITICAL RECHARGE ZONES,
Environmental Defense Fund, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04800

5C. Effects Of Pollution

GUIDELINES FOR SURFACE WATER QUALITY, VOL. 1, INORGANIC CHEMICAL SUBSTANCES, SELENIUM,
Inland Waters Directorate, Ottawa (Ontario).
A. Demayo, M. C. Taylor, and S. W. Reeder.
1979. 21 p, 1 Fig, 145 Ref.

Descriptors: *Water quality control, *Potable water, *Aquatic life, *Wildlife, *Toxicity, *Irrigation, *Industrial water, Baseline studies, Selenium, Distribution, Recommendations.

A literature survey was carried out on the toxic effects of selenium compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum selenium concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-04568

GUIDELINES FOR SURFACE WATER QUALITY, VOL 1, INORGANIC CHEMICAL SUBSTANCES, NICKEL,
Inland Waters Directorate, Ottawa (Ontario).
M. C. Taylor, A. Demayo, and S. W. Reeder.
1979, 12 p, 89 Ref.

Descriptors: *Water quality control, *Water quality standards, *Potable water, *Aquatic life, *Wildlife, *Toxicity, *Irrigation, Industrial water, Baseline studies, Distribution, Recommendations.

A literature survey was carried out on the toxic effects of nickel and nickel compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum nickel concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-04571

PHOTOSYNTHESIS AND GROWTH OF SPIRULINA PLATENSIS (CYANOPHYTA) IN AN EQUATORIAL LAKE (LAKE SIMBI, KENYA),
California Univ., Santa Barbara. Dept. of Biological Sciences.
J. M. Melack.
Limnology and Oceanography, Vol 24, No 4, p 753-760, July 1979. 4 Fig, 4 Tab, 19 Ref. NSF GB8328X and BMS 75-03441.

Descriptors: *Lake Simbi(Kenya), *Photosynthesis, *Growth rates, *Chlorophyll, *Spirulina, Cyanophyta, Euphotic zone, Dissolved oxygen, Volcanoes, Craters, Phytoplankton, Primary productivity, Limnology, Analytical techniques, Methodology, Physicochemical properties, Plant growth, Secchi disks, Surface waters, Kenya.

Abundance, growth and photosynthetic rates of a unialgal population of Spirulina platensis in Lake Simbi, Kenya were investigated August 1973-May 1974 and November 1976. Chlorophyll-a concentrations and S. platensis numerical abundance are usually exceptionally high within 1 m of the surface. During morning calm period S. platensis trichomes often accumulate at the surface. Maximal photosynthetic rates are usually high and vary 950-12,900 mg 02/cu m h; areal photosynthetic rates, determined by depth profile planimetry, range 620-5,220 mg 02/sq m h. Photosynthetic capacity in Lake Simbi is variable. Maximal photosynthetic capacity values range 1-19 mg 02/mg chl-a h and values for the euphotic zone vary 1-11.2 based on bottled phytoplankton. Estimates of maximal photosynthetic capacity for the euphotic zone range 7.1-24.2 mg 02/mg chl-a h based on free water determinations of dissolved oxygen. Exceptionally high photosynthetic rates are due to the extraordinary chlorophyll-a content in the euphotic zone (200-650 mg chl-a/ sq m). Growth rate measurements based on actual weight changes yield turnover times of 8.9-18.9 h. Lake Simbi lies 1,142 m a.s.l. and occupies a volcanic explosion crater 1 km from Lake Victoria. Seston are dull green because of dense S. platensis suspensions. Secchi disk readings vary 21-70 cm. Waters are alkaline and saline. (Danovich-Wisconsin)
W80-04647

GROWTH AND LONGEVITY IN THE CRUSTOSE RED ALGA PETROCELIS MIDDENDORFFII,
Washington Univ., Seattle. Dept. of Zoology.
R. T. Paine, C. J. Slocum, and D. O. Duggins.
Marine Biology, Vol 51, No 2, p 185-192, 1979. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Rhodophyta, *Plant growth, *Waadah Island(WA), *Life history studies, *Age, *Intertidal areas, Benthic flora, Growth rates ecology, Rocks, Algae, Distribution, Population dynamics, Mortality, Plant populations, Plant morphology, Photography, Polargraphic analysis, Petrocelis middendorffii.

Petrocelis middendorffoii, a noncalcareous red alga living in the middle-upper portion of an intertidal zone on Waadah Island, Washington, grows slowly; recruitment and mortality rates are low and the alga is capable of attaining great age. Observations were made at Waadah Island near Neah Bay, Washington, April 1970-August 1977. Total spatial separation of the four clusters studied was less than 17 m; however, indications of regional performance synchrony within this limited area were not observed. Some plants were growing; others were fragmenting. Plant surface area increased 4%/yr for those individuals growing. Age estimates, based on various growth rates, suggest that an average sized plant, 123 sq cm, is 25-87 years old. Plants of small or reduced area are more susceptible to death than larger ones; however, death does not directly relate to plant age. Causes of mortality are unknown. All plant portions are readily accessible to molluscan grazers, three of which, Collisella digitalis, Littorina sitkana and L. scutulata, are locally common. Plant periphery areas may be less edible than the central portion and the latter has an excellent capacity to reestablish itself, probably from those portions retained in the rock matrix. Petrocelis is a crustose sporophyte, prodicing tetraspores, which in turn give rise to a foliose dioecious gametophyte. Each P. middendorffii site was photographed at 1-6 mo intervals; photographs were projected and the algal surface area measured with a compensating polar planimeter. (Danovich-Wisconsin)
W80-04651

CONTINUOUS PLANKTON RECORDS: SEASONAL CYCLES OF PHYTOPLANKTON AND COPEPODS IN THE NORTH ATLANTIC OCEAN AND THE NORTH SEA,
Institute for Marine Environmental Research, Plymouth (England).
J. M. Colebrook.
Marine Biology, Vol 51, No 1, p 23-32, 1979. 10 Fig, 18 Ref.

Descriptors: *Phytoplankton, *Seasonal, *Copepods, *North Sea, *Atlantic Ocean, *Distribution, Water temperature, Upwelling, Overwintering sites, Spatial distribution, Temporal distribution, Population dynamics, Surface waters, Graphical analysis, Timing, Thermocline, Grazing, Correlation analysis, Coasts, Surveys, Growth rates, Standing crops.

Data from the Continuous Plankton Recorder survey of the North Atlantic Ocean and North Sea, 1960-1976, show that a key distribution factor for phytoplankton is the timing of the spring increase; copepod abundance is determined by the length of time food is available rather than food amounts. Distribution of overwintering stocks also influences seasonal distributions. Phytoplankton increases correlate with seasonal temperature ranges. Rapid spring increases in phytoplankton standing stocks occur over most of the open ocean which, compared with shallow water areas , si underexploited by grazing. Due to low overwintering stocks and longer generation times, copepods are unable to increase quickly enough to graze down phytoplankton within the limited growing season. In the open ocean, spring phytoplankton increases correspond with spring warming of surface waters. In the North Sea, the spring increase occurs earlier, associated with transient vertical stability periods. This results in a relatively slower increase rate. Exceptionally early spring phytoplankton increases off the Norwegian shelf and west coast of Greenland are associated with permanent haloclines. West Greenland has an exceptionally high phytoplankton standing stock relative to copepods for the whole productive season, due to low temperatures which restrict copepod development. High, late autumn, phytoplankton peaks off the coast of Portugal are due to coastal upwelling. The Grand Banks off Newfoundland are characterized by very sharp, high, spring phytoplankton peaks due to regional shallowness and low temperatures which restrict copepod growth. (Danovich-Wisconsin)
W80-04652

THE UPTAKE OF UREA BY THE DIATOM, PHAEODACTYLUM,
University Coll. of Swansea (Wales). Dept. of Botany and Microbiology.
T. A. V. Rees, and P. J. Syrett.
The New Phytologist, Vol 82, No 1, p 169-178, January 1979. 7 Fig, 3 Tab, 10 Ref.

Descriptors: *Ureas, *Diatoms, *Metabolism, *Kinetics, *Cytological studies, *Absorption, Nitrogen, Light, Plant physiology, Ammonium compounds, Phaeodactylum, Diffusion, Cultures, Laboratory tests, Chromatography, Darkness, Photoactivation, Nutrients, Nutrient requirements, Cycling nutrients, Tracers.

Urea-grown Phaeodactylum cells possess an active transport mechanism with a high-affinity for urea; presumably such high-affinity active mechanisms allow phytoplankton to utilize nitrogenous compounds at low, naturally-occurring, sea water concentrations. The mechanism leads to C14 accumulation in cells; 80% of C14 is recovered from cells as unchanged C14-urea. C14-urea uptake rates are much faster than passive diffusion rates; the half-saturation constant varies 0.6-1.0 microM. Uptake, low in cells cultured with ammonium as the nitrogen source actively develops when these cells are incubated in nitrogen-free medium for 24 h. Cycloheximide additions stop this development, indicating dependence on protein synthesis and a specific membrane protein. Uptake activity, but not urea affinity, is greatly stimulated when urea-grown cells are deprived of nitrogen 10-24 h. C14-urea uptake continues until a constant level is attained within the cells; this plateau value results from a balance between active urea uptake rates and passive diffusion loss rates. Urea transport takes place in both light and darkness, but in nitrogen-replete cells, rates in darkness are slow and are greatly stimulated by illumination. DCMU does not cause significant inhibition; however, CCCP causes almost complete inhibition, indicating that light stimulation occurs by ATP arising from photophosphorylation. (Danovich-Wisconsin)
W80-04653

THE OCCURRENCE OF A HYPERSENSITIVE REACTION IN THE PLANKTONIC DIATOM ASTERIONELLA FORMOSA HASSALL PARASITIZED BY THE CHYTRID RHIZOPHY-

DIUM PLANKTONICUM CANTER EMEND., IN CULTURE,
Freshwater Biological Association, Windermere (England).
H. M. Canter, and G. H. M. Jaworski.
The New Phytologist, Vol 82, No 1, p 187-206, January 1979. 2 Fig, 3 Tab, 30 Ref.

Descriptors: *Diatoms, *Fungi, *Parasitism, *Resistance, Metabolism, Cultures, Laboratory tests, Hosts, Microbiology, Microscopy, Infection, Mortality, Spores, Population, Growth stages, Asexual reproduction, Asterionella formosa, Rhizophydium planktonicum, Plant physiology, Cytological studies.

Hypersensitive reactions of plant cells in response to fungal parasitism takes place between cells of freshwater planktonic diatom Asterionella formosa clone CRB05 when infected by chytrid Rhizophydium planktonicum clone C2. Experiments show that most cells which react at a hypersensitive level result in failure of chytrids to increase and reach epidemic proportions on particular diatom clones in culture. Within Asterionella clone CRB05, hypersensitivity protects the total population from increasing parasitism but this does not protect individual cells. Cell reactions, either compatible or hypersensitive and incompatible, together with relative populations, make for a successful or unsuccessful host-parasite relationship. Most diatom Asterionella formosa cells in this study exhibit a hypersensitive death reaction in response to chytrid infections. On these incompatible cells, the fungus died and the encysted zoospore did not enlarge into a sporangium. However, compatible cells did bear sporangium in rare instances. Throughout this study, 4000 hypersensitively killed cells of Asterionella clone CRB05, each bearing one zoospore, were recorded. In contrast, fungus development beyond the zoospore stage occurred in only 20 cells. Therefore, most parasitized cells are classed as incompatible (hypersensitive). Experiments focused on detailed high-power light-microscope observations of numerous algal and fungal cells. (Danovich-Wisconsin)
W80-04654

SIZE-SELECTIVE PREDATION OF ZOOPLANKTON,
Ithaca Coll., NY. Dept. of Biology.
J. L. Confer, and G. Applegate.
The American Midland Naturalist, Vol 102, No 2, p 378-383, October 1979. 1 Fig, 2 Tab, 18 Ref. NSF URP SMI176-83107.

Descriptors: *Zooplankton, *Predation, *Food habits, *Particle size, Browse utilization, Animal behavior, Food chains, Diaptomus sicilis, Diaptomus pallidus, Daphnia pulex, Daphnia magna, Cyclops vernalis, Macrocyclops albidus.

Selection of prey by three species of predacious zooplankton species was analyzed. One three predators (Epischura lacustris, Macrocyclops albidus, and Cyclops vernalis) and three to ten prey (Diaptomus sicilis, D. pallidus, Daphnia pulex, and D. magna) were placed into aquaria. All aquaria were examined every 24 hours. The results were expressed as number of prey killed rather than eaten. The number of prey killed per predator/day ranged from 0.2 with Cyclops vernalis up to 4.2 with Macrocyclops albidus. Estimated predation rates showed large weekly variations. These variations may reflect real differences that occur in nature over a short time interval. Higher rates of predation were observed at higher densities. When offered a choise of prey, the predators generally selected the smallest prey and avoided the largest prey. In some experiments selection for the smallest prey occurred regardless of whether the smallest prey was a copepod or a cladoceran. The smallest prey used in these experiments were not as small as some which are available to zooplankton in lakes. Consequently, the results of the experiments do not necessarily suggest the smallest prey that the predators are capable of eating, nor the size of prey that the predators would prefer when a natural range of sizes is available. (Harris-Wisconsin)
W80-04655

A CONTRIBUTION TO THE PHOSPHORUS LOADING CONCEPT,
Technische Univ., Dresden (German, D.R.). Bereich Hydrobiologie.
J. Benndorf.
Internationale Revue der Gesamten Hydrobiologie, Vol 64, No 2, p 177-188, 1979. 3 Fig, 2 Tab, 28 Ref.

Descriptors: *Eutrophication, *Model studies, *Orthophosphate, *Detention reservoirs, Estimating equations, German Democratic Republic, Organic loading, Phosphorus, Phytoplankton, Sedimentation, Growth rates, Light intensity, Reservoirs, Cycling nutrients.

Two modifications were tested on the empirical eutrophication model developed by Vollenweider and Dillon (1974) and Vollenweider (1976): (1) Total phosphorus is replaced by orthophosphate phosphorus; (2) An outwash limit is introduced for very short residence times. The new orthophosphate-related constants of the model have been calculated for reservoirs. These new values differ from the original constants chiefly in that the new sinking velocity values for oligotrophic reservoirs are different from values for mesotrophic and eutrophic man-made lakes. This difference is caused by the vertical stratification of orthophosphate and the deep water outlet from reservoirs. The time-dependent outwash limit is also calculated from the equation. Critical orthophosphate load limits have been checked using mean values from 19 reservoirs and primary reservoirs located in the German Democratic Republic. A high degree of conformity between the model and the measured eutrophication state has been found. In addition, the outwash limits have been tested by means of random sampling at the primary reservoirs Weida and Bautzen. Of 17 samples only one did not fit the model. (Harris-Wisconsin)
W80-04656

THE CHEMISTRY OF LAKE MYVATN AND RIVER LAXA,
Marine Research Inst., Reykjavik (Iceland).
J. Olafsson.
Oikos, Vol 32, No 1-2, p 82-112, 1979. 16 Fig, 22 Tab, 46 Ref.

Descriptors: *Water chemistry, *Lake Myvatn(Iceland), *River Laxa(Iceland), Eutrophication, Nitrogen, Phosphorus, Cyanophyta, Anabaena flos-aquae, Hypolimnion, Diatoms, Lake morphology, Cycling nutrients, Iceland, Nutrients.

High phosphorus loading of Lake Myvatn, Iceland is the primary cause of the dense algal blooms which develop in the lake. The nitrogen/phosphorus ratio is too low for green algae. However, the excess phosphorus is utilized by blooms of the nitrogen fixing blue-green alga Anabaena flos-aquae. As a result of the high production rate of organic matter in winter in the lake, oxygen-deficient conditions may develop in some parts of the lake. The lake has a short water retention time. However, much of the hypolimnion is isolated under the ice by thermal stratification from the water flowing through the lake. The diatom mining operation in the Ytrifloi basin exceeds the rate of sediment deposition and is responsible for changes in the morphological characteristics of the basin. By 1977 the volume of the lake has increased by 32%. In addition, the mining operation has also affected the nutrient chemistry of the springs which drain into the basin. Phosphorus and nitrogen loading rates have increased by 20% and 96% respectively, and at present only a fraction of the mobilized nutrients find their way back to the lake. Decrease in phosphorus content of the mining effluents would be desirable. Phosphorus decrease would cause a decrease in the annual production of algal biomass and a change in the nitrogen/phosphorus ratio which in turn would eliminate many of the nitrogen fixing algae such as Anabaena that cause periodic algal blooms in the lake. (Harris-Wisconsin)
W80-04657

SECONDARY PRODUCTION OF EPILITHIC FAUNA IN A WOODLAND STREAM,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
R. J. Neves.
The American Midland Naturalist, Vol 102, No 2, p 209-225, October 1979. 1 Fig, 6 Tab, 75 Ref.

Descriptors: *Secondary productivity, *Streams, *Epilithic fauna, *Aquatic insects, Factory Brook(MS), Trophic level, Benthos, Food chains, Biomass, Diptera, Ephemeroptera, Trichoptera, Plecoptera, Massachusetts.

In July 1973 three sets of 40 cobblis were placed across a riffle in Factory Brook, Massachusetts in order to sample the biomass and productivity of epilithic fauna. One 40-cobble set was sampled each month from September 1973 to August 1975, allowing three months for recolonization. Insect order according to numerical abundance were Diptera (55.8%), Ephemeroptera (31.9%), Trichoptera (7.3%), and Plecoptera (1.8%) for the two-year period with little variation between years. In 1975 the mean faunal density was 3088 individuals/sq m. Seasonal changes in epilithic fauna generally reflected differences in numerical abundance during the year. Mayflies dominated cobble biomass, followed by caddis flies, stone flies and dipterans; the occurrence of other orders was extremely variable but significant during several months. Total biomass on cobbles amounted to 646.7 mg dry weight/sq m/year in 1974 and 610 mg dry weight/sq m in 1975. Estimated annual production on cobbles during 1974 was 4804.9 mg dry weight/sq m/year and 4315.1 mg dry weight/sq m/year in 1975. Most of the invertebrate production on cobbles was attributed to relatively few abundant and common species. Predators made up 18.5-20.4% of the biomass and contributed 11.1-13.6% of invertebrate production on cobbles. The remaining biomass and production was attributed to herbivores and detritivores. Annual energy production was 24.7 kcal/sq m in 1974 and 22.3 kcal/sq m in 1975. (Harris-Wisconsin)
W80-04658

THE OXYGEN BALANCE OF LAKE MYVATN, ICELAND,
Miljoestyrelsen, Silkeborg (Denmark). Freshwater Lab.
C. Hunding.
Oikos, Vol 32, No 1-2, p 139-150, 1979. 11 Fig, 7 Tab, 30 Ref.

Descriptors: *Lake Myvatn(Iceland), *Oxygen, *Primary productivity, Oxygen demand, Eutrophication, Benthos, Water temperature, Oxygenation, Cladophora aegagropila, Diatoms, Photosynthesis, Sediment-water interfaces, Iceland, Phytoplankton.

During 1973 and 1974 in-situ limnological experiments were conducted at Gardsvogar Beach, Lake Myvatn, Iceland. In this area, cold spring water overflows sediment submerged only 0.5 m below the water surface, and keeps it clean of detrital material. The purpose of the experiments was to quantify the rates of benthic microalgal production and community respiration by following the oxygen change in the water over the sediment in light and dark undisturbed sediment cores. Oxygen uptake of the sediment community correlated with the temperature of the water over the sediment. Variations of water movement over the sediment also affected the rate of community oxygen uptake. Based on measured values of oxygen production and uptake of the sediment community, daily oxygen production was calculated at about 800 mg 02/sq m, and community oxygen uptake at about 1300 mg 02/sq m during July-August. Net oxygen change amounted to +689 mg 02/cu m from 0600 to 2040 hours, and -576 mg 02/cu m from 2040 to 0600 hours. Daily net oxygen production at 80 cm water depth was +113 mg 02/cu m. Colonies of Cladophora which grew on the bottom of the central parts of the lake were locally abundant and reached densities of 1,800,000 individuals/sq m in 1973. They were well adapted to illumination intensities at the sediment surface. In spite of the positive daily oxygen balance of the lake, a marked decline in oxygen balance occurred during storms due to increased oxygen uptake by the suspended sediments. (Harris-Wisconsin)

W80-04661

ZOOPLANKTON AND ITS RELATION TO AVAILABLE FOOD IN LAKE MYVATN,
National Energy Authority, Reykjavik (Iceland).
H. Adalsteinsson.
Oikos, Vol 32, No 1-2, p 162-194, 1979. 25 Fig, 4 Tab, 113 Ref.

During the ice-free seasons in 1972 and 1973 and the ice-bound season in 1972, water samples were taken from 16 stations evenly distributed through all three basins of Lake Myvatn, Iceland. The whole water column was sampled at each station. The number of individuals from different zooplankton taxonomic groups was counted in each sample. Biomass of phyto- and zooplankton was estimated by calculating the volumes of the geometric configurations of the organisms. Due to shallowness of the lake (ca. 2 m) sediment is often suspended and quantitatively dominates phytoplankton. Among the phytoplankton, chrysomonads dominate in winter. After ice break they are replaced by diatoms. These in turn are followed by a new peak of chrysomonads. Anabaena flos-aquae dominates during summer, and diatoms again during autumn. Among the zooplankton, Cyclops abyssorum Sars is dicyclic, with the first generation appearing in spring and the second in July-August. The total zooplankton production was 30-100 g fresh weight/sq m. Annual fluctuations were mainly dependent on Daphnia production. Phytoplankton biomass averages 2-2.5 times higher, and production 10-20 times higher than corresponding values for zooplankton. The differences in the zooplanktonic species composition between the three basins of the lake are caused by the combination of the following factors: bloom of Anabaena, fish predation, and sediment suspension. (Harris-Wisconsin)
W80-04662

PHYTOPLANKTON PRODUCTION IN SHALLOW EUTROPHIC LAKE MYVATN, ICELAND,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
P. Jonasson, and H. Adalsteinsson.
Oikos, Vol 32, No 1-2, p 113-138, 1979. 21 Fig, 9 Tab, 76 Ref.

Descriptors: *Lake Myvatn(Iceland), *Phytoplankton, *Primary productivity, Eutrophication, Water temperature, Ice cover, Opacity, Light penetration, Cycling nutrients, Radiation, Chlorophyll, Benthos, Diatoms, Photosynthesis, Chrysophyta, Anabaena flos-aquae, Seasonal, Iceland, Solar radiation.

Lake Myvatn is a shallow eutrophic lake in northeastern Iceland consisting of three irregular basins. During the six year period between 1971-1976, samples for measurement of primary gross production were collected at six stations on the lake. In addition, physical and chemical properties of the lake environment, such as water temperature, ice cover, global radiation, transparency, wind speed, resuspension and nutrient budget, were measured. The southern basin produced 118 g C/sq m/year; the northern basin produced 75 g C/sq m/year; and the eastern basin produced 50 g C/sq m/year. Availability of phosphorus seems to limit phytoplankton production. Seasonal succession of phytoplankton followed a trend similiar to that of temperate eutrophic lakes. The phytoplankton succession was: diatoms in spring and autumn, chrysophyceans in early summer and autumn, Anabaena flos-aquae in summer. The chlorophyll content was low in spring and early summer and dropped rapidly after the high values during the Anabaena bloom. Intermittently high values observed regularly in autumn were associated with resuspended benthic diatoms. High production due to Anabaena coincided with high radiation, high temperature and the time of ice-break. Despite high biomass, production was low at other seasons. The interrelationship between chlorophyll-a, biomass production and turnover time of phytoplankton are also discussed. (Harris-Wisconsin)
W80-04664

COMPARATIVE CARBOHYDRATE STORAGE AND UTILIZATION PATTERNS IN THE SUBMERSED MACROPHYTES, MYRIOPHYLLUM SPICATUM AND VALLISNERIA AMERICANA,
Wisconsin Univ.-Madison. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W80-04665

PREVENT GROUND WATER CONTAMINATION BEFORE IT'S TOO LATE,
Camp, Dresser and McKee, Boston, MA.
For primary bibliographic entry see Field 5B.
W80-04666

ACUTE TOXICITY OF RESIDUAL CHLORINE AND AMMONIA TO SOME NATIVE ILLINOIS FISHES,
Illinois State Water Survey, Urbana.
D. P. Roseboom, and D. L. Richey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170871, Price codes: A03 in paper copy, A01 in microfiche. Report of Investigation 85, 1977. 42 p, 10 Fig, 61 Ref, 5 Append.

Descriptors: *Chlorine, *Ammonia, *Illinois, *Water quality standards, *Water pollution effects, Water temperature, Freshwater fish, Bioassay, Toxicity, Mortality, Laboratory tests, Channel catfish, Bass, Sunfishes.

Ninety-six hour residual chlorine bioassays were conducted on bluegill and channel catfish. In 96-hour acute toxicity studies with ammonia (NH_3-N), bass in addition to bluegill and channel catfish, were included. The studies were performed in waters typical of most lakes and streams in midwestern states, i.e., relatively high in alkalinity and the salts of calcium and magnesium. Observations regarding the characteristics and reaction of the fishes to each toxicant were noted. For residual chlorine the 96-hour TL50s ranged from 0.18 to 0.33 mg/l for bluegill, depending on temperature and fish weight. For channel catfish the TL50 was about 0.09 mg/l; temperature was not a factor. For ammonia the 96-hour TL50s for bluegill were dependent on temperature and fish weight and varied from 0.40 to 1.3 mg/l. Size was not a factor for bass and channel catfish. Ninety-six hour TL50s for these fishes ranged from 0.72 mg/l at 22C to 1.2 mg/l at 30C for bass and 1.5 mg/l at 22C to 3.0 mg/l at 28C for channel catfish. For the protection of the fishes investigated, and consistent with the water pollution regulations of Illinois, residual chlorine in Illinois waters should not be detectable and NH_3-N should not exceed a concentration of 0.04 mg/l.
W80-04668

RESPONSE OF BIOLOGICAL REACTORS TO THE ADDITION OF POWERED ACTIVATED CARBON,
Connecticut Univ., Storrs. Dept. of Chemical Engineering.
D. W. Sundstrom, H. E. Klei, T. Tsui, and S. Nayar.
Water Research, Vol 13, p 1225-1231, 1979. 11 Fig, 5 Ref. OWRT A-057-CONN(2).

Descriptors: *Activated sludge, *Activated carbon, *Sewage treatment, Biological treatment, Phenols, Sludge treatment, Waste treatment, Water quality, Control, Sewage effluents, Municipal wastes, Industrial wastes.

A biological reactor operating on a synthetic feed was subjected to impulse and step disturbances of glucose and phenol. Powdered activated carbon was applied either as an impulse or as a step change to control reactor conditions. With glucose as the substrate, the addition of powdered carbon reduced the steady state TOC concentrations significantly but only slightly moderated the concentration transients after an upset. For impulse inputs of phenol, the simultaneous addition of carbon greatly reduced the magnitude of the transient changes in concentration. With step inputs of phenol, carbon addition rapidly lowered the phenol concentration in the reactor and permitted continuous operation with inlet phenol concentrations above 1000 mg/l. Thus, powdered carbon can provide an effective control method for maintaining effluent quality in the presence of toxic upsets. (Deal-EIS)
W80-04680

OXYGEN CONTENT AND TOXICITY FOR FISH OF SOME SUBSTANCES IN HEATED WATERS,
Institute of Meteorology and Water Management, Warsaw (Poland). Dept. of Water Economics.
For primary bibliographic entry see Field 5A.
W80-04681

LETHAL TEMPERATURES FOR FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
For primary bibliographic entry see Field 5A.
W80-04682

BEHAVIOUR OF FISH IN A THERMALLY DIFFERENTIATED ENVIRONMENT,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
L. Horoszewicz, and B. Morawska.
Polish Ecological Studies, Vol 5, No 3, p 33-42, 1979. 5 Fig.

Descriptors: *Water temperature, *Thermal water, Electric power plants, *Fish behavior, Fish migration, *Fish physiology, Fresh water fish, Warm water fish, *Salmon, Atlantic salmon, *Preferred temperature, *Lethal temperature, Juvenile fish, Fish populations, *Vistula River(Poland), *Poland.

Discharge canals and heated zones are not totally abandoned by fish even at highest summer temperatures of water reaching 30-35C. Warm-water fishes form local populations adapted to elevated temperatures in the heated areas of water. Heated environments become areas of intensive reproduction of these fish species which in changed thermal, hydrological and morphological conditions of a water body find suitable conditions for spawning, that is a suitable substratum, flow, depth and temperature for spawning. Migratory salmonid fish do not acclimate to the high temperatures of discharge waters, and the ability to select cool currents makes it possible for these species to pass the heated areas of rivers and lakes even during the warmest periods. In comparing the above observations and the preferred temperatures of local species of fish laying between 9 and 28C, with the exception of salmonids, with predicted heating of waters, one can assume that for most fish species in the Vistula River, the temperatures of heated zone will be attractive, with the exception of the summer period with its low water level and temperatures exceeding 28.5C. Such temperatures were avoided by juveniles of three species, although adult individuals of two of these species and five other species were caught at higher temperatures reaching 33.5C. This does not by any means signify that such species will always occur in large numbers in discharge areas. (Katz-EIS)
W80-04683

FISH METABOLISM,
Institute of Applied Biology, Siedlce (Poland).
For primary bibliographic entry see Field 5A.
W80-04684

SEXUAL MATURITY OF FISH IN HEATED WATERS,
Wyzsza Szkola Rolnicza, Krakow (Poland). Inst. Zoologiczny Stosowanej.
P. Epler, and K. Bieniarz.
Polish Ecological Studies, Vol 5, No 3, p 52-63, 1979. 6 Fig, 3 Tab.

Descriptors: *Water pollution effects, *Fish physiology, *Fish behavior, Aquiculture, Growth, Fish reproduction, Fish eggs, Egg development, *Water temperature, Heated effluent, Thermal electric power, *Poland, *Vistula River(Poland), Fresh water fish, Premature spawning.

Increase in water temperature in the Vistula River will have the following undesireable effects on the reproduction of fish. These are premature spawning, and disturbed development of the fish eggs. The following favorable effects may be observed; the earlier spawning of many fish species, an increase in the number of spawnings and a prolongation of the spawning period. The authors feel that in the Vistula River the unfavorable changes will be balanced by favorable changes although not always in the same species. (Katz-EIS)
W80-04685

SPAWNING OF FISH AND THEIR EMBRYONIC AND LARVAL DEVELOPMENT,
Wroclaw Univ. (Poland). Muzeum Zoologiczny.
B. Kokurewicz.
Polish Ecological Studies, Vol 5, No 3, p 64-71, 1979. 3 Fig.

Descriptors: *Fish physiology, *Fish behavior, *Fish reproduction, Water pollution effects, *Water temperature, Thermal pollution, Thermal power, *Thermal power plants, Aquiculture, Spawning periods, Heated environments, Fish eggs, Fresh water fish, *Vistula River(Poland), *Poland.

Comparison of spawning periods of fish in natural waters with changes taking place in heated environments allows for assuming the following conclusions. Spawning in heated zones will take place earlier and at optimal temperatures or temperatures tolerated for embryonic development (perch, pike-perch, roach). One other possibility is an earlier spawning and prolonging the period of reproduction by increasing the number of batches (tench, bleak, bream). Danger to the reproduction of phytophilus fish in heater environments is not caused by temperature increase, but by the lack of spawning grounds. The latter can be destroyed a result of regulating and embanking the river, or due to the fact that temperature increase precedes spring rising of waters. Fish may be ready to spawn earlier and as result of the lack of suitable spawning grounds (for example on areas flooded later) depositing of spawn can be retarded. Similarly as spawning, embryonic development should likewise take place within the range of optimal temperatures, that is increasing gradually from mid-February to the end of June from 10 to 24C. Fish species such as the bleak, rudd, tench, commencing multi-batch spawning in warm waters can meet with high temperatures of over 28C in July and August, that is unfavorable for reproduction toward the end of the reproducing period, especially at low water levels. Reducing the period of embryonic development can be favorable providing temperature increase will remain within the range of temperatures optimal for the development of a given fish species. (Katz-EIS)
W80-04686

FEEDING OF FISH AND THEIR FEEDING GROUNDS,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
For primary bibliographic entry see Field 5A.
W80-04687

GROWTH OF FISH IN HEATED ENVIRONMENTS,
Instytut Rybactwa Srodladowego, Olsztyn-Kortowo (Poland). Dept. of Ichthyology.
H. Wilkonska.
Polish Ecological Studies, Vol 5, No 3, p 80-85, 1979. 2 Fig.

Descriptors: *Fresh water fish, *Fish growth, *Vistula River(Poland), *Poland, *Cooling water, Juvenile fish, Adult fish, *Thermal effluents, Perch, Fisheries, Water temperatures, Water pollution Effects, Thermal power plant, Low water flow.

Heating of the Vistula River will result in an increased growth rate of juveniles of most species occurring in the heated area. Predicted increase of temperature above 28C in case of low water flow (June, July, August) can inhibit the growth of fish, and should be lowered by proper changes of power plant performance. Although warm-water species form local populations in heated zones, no significant changes are to be expected with respect to growth rate of adult fish in the Vistula, this being due to stream-like discharge of heated effluents and its rapid cooling along a short stretch (no more than a few hundred meters) of the river. (Katz-EIS)
W80-04688

TEMPERATURE CHANGES AND FISH DISEASES,
Instytut Rybactwa Srodladowego, Piaseczno (Poland). Dept. of Fish Culture.
B. Pietrzak.
Polish Ecological Studies, Vol 5, No 3, p 86-94, 1979. 1 Fig, 3 Tab.

Descriptors: *Fish diseases, *Fish parasites, *Fish physiology, Fish behavior, Water pollution effects, Thermal power plants, Cooling waters, *Water temperature, Fish pathogen, Immunological responses, Bacteria, Virus, Thermal optimum, Fish parasites.

Changes of one environmental factor, in this case temperature, which favor the development of some pathogens and inhibit others, do not necessarily mean that certain fish diseases will occur, and other - disappear. It is worth to repeat after Snieszko (1974) that a disease occurs when there is a virulent pathogen, a susceptible host (i.e. fish), and proper environmental conditions. Temperature, although important, constitutes only one of many environmental factors. Our predictions, based on only scarce data, should be treated rather as a warning; they point to some possibilities, but there are no bases for assuming that these or other diseases and parasite invasions will occur after heating of the river. Predicted temperatures of the Vistula River affected by heated effluents will create conditions favouring immunological processes in cyprinids. At the same time bacteria will find favourable thermal conditions over a prolonged period. In case of viral diseases, their thermal optima will last two months longer than in natural environments. It is also possible that invasions of parasites will be intensified. (Katz-EIS)
W80-04689

CHANGES OF FISH COMMUNITIES IN HEATED ENVIRONMENTS,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
L. Horoszewicz.
Polish Ecological Studies, Vol 5, No 3, p 95-99, 1979. 1 Fig.

Descriptors: *Water pollution effects, *Fish populations, *Fish reproduction, Fish behavior, Fish migration, *Vistula River(Poland), *Poland, Cooling water, Discharge channels, Fresh water fish, Reservoirs, Fish fauna, Aquatic plants.

Comparison of the trends taking place in fish communities in different reservoirs in a variety of environments quite clearly points to species capable of invading or at least of maintaining their dominance in heated environments of the temperate climatic zone, now matter how differentiated. Beginning from the most plastic and vigorous ones, these species can be arranged as follows: bleak, roach, bream, and white bream. Two other species - rudd and chub - are common components of fish fauna in heated waters, but they exclude each other as dominants. Most frequently, predomination of one of them is determined by flow rate, and thus by amount and type of submerged water vegetation. This statement is supported by chub catches at mouths of discharge canals in both water bodies under study (Ivankovskoe and Kucurgan), as well as by visible increase of chub numbers in Lichenskie and Slesinskie lakes in the last 3 years of studies i.e. after the introduction of safety cooling system. As regards predatory species, perch is most frequently found in heated waters whereas pike disappears. Some increase of crucian carp, tench, carp, and pike-perch may be noted in water bodies with abundant vegetation, and of bass and bullhead catfish in heated flowing waters. Response of undermouth and barbel is still unclear. It is probable that both species periodically migrate from cool to heated parts. There are on data sufficient for predicting the responses of other not abundant and sporadically occurring fish species. (Katz-EIS)
W80-04690

THE IMPACT ON ICHTHYOFAUNA AND POSSIBLE CONTROL OF THE EFFECTS OF THERMAL DISCHARGE,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
For primary bibliographic entry see Field 5A.
W80-04691

ACCUMULATION OF 210PB IN FRESHWATER PLANTS,
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany.
For primary bibliographic entry see Field 5B.
W80-04692

EFFECTS OF SEAWATER SUSPENSIONS OF IRON ORE DUST ON FUCUS OOSPHERES,
Glagow Univ. (Scotland). Dept. of Botany.
A. D. Boney.
Marine Pollution Bulletin, Vol 11, p 41-43, 1980. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Marine algae, *Iron, *Inhibition, *Reproduction, Physiology, Water chemistry, Metals, Suspended solids, Mode of action, Particle size, *Fucus, Bioassay.

When shaken in ore dust suspensions and when made to sink through ore dust suspensions in water columns, freshly liberated Fucus oospheres (eggs) act as centers for the buildup of dust particle aggregates. Dust laden oospheres are less efficient as attractants of spermatozoids. The amounts of dust-'loading' of the eggs depends on the initial sizes of the djust particle aggregates form in seawater. (Deal-EIS)
W80-04693

THE EFFECTS OF MERCURY EXPOSURE ON INTRACELLULAR DISTRIBUTION OF MERCURY, COPPER AND ZINC IN SKELETONEMA COSTATUM (GREV.) CLEVE,
British Columbia Univ., Vancouver. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W80-04695

UPTAKE AND ELIMINATION OF ANTIMONY IN THE MUSSEL, MYTILUS EDULIS,
Institute fuer Meeresforschung, Bremerhaven (Germany, F.R.).
F. Walz.
Veroffentlichungen des Institut fur Meeresforschung in Bremerhaven, Vol 18, p 203-215, 1979. 4 Fig, 1 Tab, 23 Ref.

Descriptors: *Metals, *Absorption, *Mussels, *Toxicity, Mortality, Mode of Action, Chemical properties, Path of pollutants, Mathematical models, Animal physiology, Animal metabolism, Animal growth, *Antimony, *Tissue analysis, *Bioaccumulation, *Depuration.

In experiments of 186 days, antimony (as antimonyl-tartrate) showed no toxic effects up to concentrations (nominal) of 5 mg Sb/l. At 10 mg Sb/l some mortality occurred, and shell deformations. 17-20 mm Mytilus edulis accumulate antimony from sea water with concentration factors (on the basis of dry weight of total tissues) of 59-103, higher values at concentration 5 mg Sb/l, lower values at 0.15 mg Sb/l. Uptake is more or less linear during the initial phase of experiments (about 30 days) until steady state conditions are reached. In elimination experiments biological half life time is 17.8 days, regardless of initial concentrations in tissues. The monocompartment model of Ruzic is an imperfect description of uptake kinetics; probably a multicompartment model is needed. (Deal-EIS)
W80-04697

THE CONTENT OF CERTAIN METALS IN THE SOFT TISSUES OF THE BIVALVE MOLLUSKS TRIDACNA SQUAMOSA FROM ISLANDS OF THE TROPICAL ZONE OF THE PACIFIC OCEAN IN CONNECTION WITH ENVIRONMENTAL CONDITIONS,
Akademiya Nauk SSSR, Vladivostok. Lab. of Geochemistry.
N. K. Khristoforova, N. N. Bogdanova, and A. I. Obukhov.
The Soviet Journal of Marine Biology, Vol 5, No 3, p 217-222, 1979. 1 Fig, 4 Tab, 7 Ref.

Descriptors: *Heavy metals, *Mollusks, *Pacific Ocean, Iron, Manganese, Copper, Zinc, Lead, Benthic fauna, Littoral, Bottom sediments, Geochemistry, Geomorphology, Pacific Ocean, Bagaman Island, *Tissue analysis, *Tridacna.

The content of the heavy metals Fe, Mn, Cu, Zn, and Pb in the soft tissues of Tridacna inhabiting the inshore waters of islands of early origin is determined. It is shown that the trace element composition of mollusk tissues depends on the geomorphology of the islands, chemical composition of the substrate, content of metals in the water, and the dynamics of the water masses. In spite of the constant chemical composition of oceanic waters and the apparent uniformity of environmental conditions, the inshore zones of different islands are individual in their combination of hydrogeochemical parameters, which is reflected in the tissue composition of the mollusks. (Deal-EIS)
W80-04698

THE EFFECTS OF HARDNESS, ALKALINITY AND PH OF TEST WATER ON THE TOXICITY OF COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Univ., Edmonton. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-04699

TOXICITY OF BUTOXYETHYL ESTER OF 2,4-D TO SELECTED SALMON AND TROUT,
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).
For primary bibliographic entry see Field 5A.
W80-04700

VARIABLES AFFECTING BODY BURDENS OF LEAD, ZINC AND CADMIUM IN A ROADSIDE POPULATION OF THE SNAIL CEPAEA HORTENSIS MULLER,
Durham Univ. (England). Dept. of Zoology.
P. Williamson.
Oecologia (Berl.), Vol 44, p 213-220, 1980. 3 Fig, 3 Tab, 76 Ref.

Descriptors: *Lead, *Zinc, *Cadmium, *Snails, Heavy metals, Path of pollutants, *Animal physiology, Animal metabolism, Regression analysis, Animal populations, Seasonal, Chemical properties, *Tissue analysis, *Bioaccumulation.

Application of multiple regression analysis to the lead, zinc and cadmium contents of 985 Cepaea hortensis collected from a suburban roadside site over two years showed that body weight, age and daylength were the major factors affecting soft tissue body burdens. Other highly significant influences were physiological changes at the juvenile-adult transition, vapour pressure deficit for the two days before sampling, and mean rainfall for the ten days before. Together these factors accounted for 69%, 79% and 87% of the total variance in lead, zinc and cadmium body burdens respectively. Unexplained variance was provisionally ascribed to individual differences in recent diet and digestive activity. The digestive gland contained the majority of the total body burden of each metal and played an important role in lead and zinc elimination. Whereas levels of lead in C. hortensis fluctuated rapidly, zinc was exchanged more slowly, perhaps by active regulation, and cadmium was effectively immobile, accumulating progressively with age. The implications of these results to the predators of land snails, and to terrestrial monitoring programmes, are discussed. (Deal-EIS)
W80-04702

OIL POLLUTION AND SEABIRDS: ATLANTIC CANADA 1976-77 AND SOME IMPLICATIONS FOR NORTHERN ENVIRONMENTS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Dept. of Fisheries and Oceans.
E. M. Levy.
Marine Pollution Bulletin, Vol 11, p 51-56, 1980. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Oil spills, *Birds, *Mortality, Canada, Atlantic Ocean, Oil, Oil pollution, Fuels, Mode of action, Arctic, Animal physiology, Chemical analysis, Gas chromatography.

Chemical analyses of the oils on dead or moribund seabirds from Atlantic Canada during the winter of 1976-77 indicated that some of the birds were contaminated with oil spilled by the Argo Merchant grounding, some by oil probably from the Grand Zenith sinking, and still others by oil from various small local spills of unknown origin. These victims demonstrated that an extremely minute oiling may lead to the death of a seabird when the effects of the oil are synergistically combined with the stresses imposed by severe environmental conditions. This may intensify the impact of oil in the Arctic and thereby have a profound effect on seabird populations. (Deal-EIS)
W80-04705

POLYCHLORINATED BIPHENYLS AND OTHER ORGANIC CHEMICAL RESIDUES IN FISH FROM MAJOR WATERSHEDS OF THE UNITED STATES, 1976,
Environmental Research Lab.-Duluth, MN.
G. D. Veith, D. W. Kuehl, E. N. Leonard, F. A. Puglisi, and A. E. Lemke.
Pesticides Monitoring Journal, Vol 13, No 1, p 1-11, 1979. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Polychlorinated biphenyls, *Water quality standards, *Freshwater fish, *Pesticide residues, DDT, Chlorinated hydrocarbon pesticides, Phenols, Chemical analysis, Gas chromatography, Watersheds(Basins), Chlorinated benzenes, Styrenes, Anisoles, *Tissue analysis, *Bioaccumulation, *HCB, *Chlordane, Phenols, Anilines, Propanes, Butadiene, Petroleum hydrocarbons.

Composite samples of fish were collected from major United States watersheds in 1976 and analyzed for PCBs and related organic chemicals. PCBs were found in 93 percent of the fish samples; 53 percent of the samples contained more than 5 ppm PCBs, whole fish basis, which is the current tolerance level set by the U.S. Food and Drug Administration. Only 14 percent of the samples contained less than the proposed action level of 2 ppm PCBs. PCB concentrations ranged from less than 0.3 ppm to 140 ppm in the composite samples. Sigma DDT concentrations ranged from less than 0.05 ppm to 4.53 ppm. Hexachlorobenzene was identified in 19 percent of the samples, and chlordane components were identified in 36 percent of the samples. Chemicals identified by gas chromatography/mass spectrometry but not quantified include chlorinated benzenes, styrenes, anisoles, phenols, anilines, propanes, and butadienes, as well as mixtures of petroleum hydrocarbons. (Deal-EIS)
W80-04706

EFFECTS OF URBAN RUNOFF AND TREATED MUNICIPAL WASTEWATER ON A MAN-MADE CHANNEL IN NORTHEASTERN ILLINOIS,
Metropolitan Sanitary District of Greater Chicago, IL.
I. Polls, C. Lue-Hing, D. R. Zenz, and S. J. Sedita.
Water Research, Vol 14, p 207-215, 1980. 7 Fig, 6 Tab, 17 Ref.

Descriptors: *Sewage effluents, *Toxicity, *Biological communities, Municipal wastes, Water quality, Sewage treatment, Runoff, Benthic fauna, Isopods, Oligochaetes, Diptera, Nutrients, Ammonia, Nitrogen, Phosphorus, Water chemistry, Illinois, Chicago River, North Shore Channel(Northeastern Ill).

The benthic macroinvertebrates and water quality were sampled monthly at five locations in the North Shore Channel (northeastern Illinois) from January through November 1973. Secondary treated effluent enters the channel from the Northside Sewage Treatment Plant, 5.4 km above its junction with the North Branch of the Chicago River. Street and combined sewer overflows located above and below the treatment plant outfall discharge to the channel only during storm events. Compared to a biological survey conducted by the U. S. Public Health Service 12 years prior, the present study revealed that the most important change in the benthic faunal composition downstream from the Northside Plant final effluent outfall was the appearance of large numbers of midges and isopods, suggesting improvement in water quality. In 1961, the fauna was composed principally of pollution tolerant oligochaetes. The 1973 study showed that the water quality in the channel was markedly influenced by a combination of both urban runoff and a point source effluent from the Northside Sewage Treatment Plant. Mean concentrations of ammonium nitrogen, nitrite-nitrate nitrogen, total phosphorus and conductivity increased significantly downstream from the treatment plant outfall compared to values upstream. (Deal-EIS)
W80-04710

THREE TYPES OF SKIN PAPILLOMAS OF FLATFISHES AND THEIR CAUSES,
Hamburg Univ. (Germany, F.R.). Zoologisches Inst.
For primary bibliographic entry see Field 5A.
W80-04713

EFFECTS ON RAINBOW TROUT (SALMO GAIRDNERI) OF A CHRONIC EXPOSURE TO WATERBORNE SELENIUM,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Lab.
For primary bibliographic entry see Field 5B.
W80-04714

INFLUENCE OF SECONDARILY TREATED KRAFT MILL EFFLUENT ON THE ACCUMULATION RATE OF ATTACHED ALGAE IN EXPERIMENTAL CONTINUOUS-FLOW TROUGHS,
Weyerhauser Co., Tacoma, WA. Environmental Technology Dept.
M. L. Bothwell, and J. G. Stockner.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 248-254, 1980. 5 Tab, 31 Ref.

Descriptors: *Pulp wastes, *Toxicity, *Diatoms, Aquatic algae, Growth rates, Seasonal, Inhibition, Pulp and paper industry, Nutrients, Nitrogen, Ammonia, Periphyton, Nitrates, Nitrites, Kraft mill effluent, Bioassay.

In three seasonal experiments in 1977, increases in the rate of attached algal accumulation were normally found with each additional increment of secondarily treated kraft mill effluent (KME). The effect of KME on the instantaneous accumulation coefficients of algae were 1.2-2.8 times greater in the summer than in the autumn or spring at all dilutions tested. At higher concentrations (5 and 25% v/v KME) an inhibition of accumulation was usually observed during the first 5-6 d of exposure; after this period diatom biomass increased sharply. Succession of diatom taxa to different forms, rather than physiological adaptation by usually predominant species occurred. No inhibition was noted at lower concentrations (0.5, 1, and 2% v/v) of KME. Relatively high levels (20-30 microg/l) of soluble reactive phosphorus (SRP) and low concentrations of nitrate + nitrite-nitrogen (5-10 microg/l) and ammonia-nitrogen (2-20 microg/l) in the river dilution water suggested that nitrogen was the primary limiting nutrient. Ammonium uptake tests for nitrogen deficiency confirmed nitrogen limitation in algae grown in unenriched river water compared to algae exposed to KME for 6 d. Differences in chlorophyll a: ATP ratios among periphyton communities of the different treatments were minimal after 9 d. (Deal-EIS)
W80-04715

ZOOPLANKTON AS AN INDICATOR OF POLLUTION OF RESERVOIRS,
Tagliatti Hydrometeorological Observatory (USSR).
N. A. Dzyuban, and S. P. Kuznetsova.
Hydrobiological Journal, Vol 14, No 6, p 35-39, 1978. 1 Fig, 21 Ref.

Descriptors: *Bioindicators, *Zooplankton, *Water quality, *Reservoirs, Trophic level, Monitoring, Dominant organisms, Mathematical models, Statistical analysis, Biological communities, Water pollution effects, *Species diversity, *Diversity indices.

This article describes the first data on biomonitoring by the network of the USSR Hydrometeorological Service, and new patterns of response of zooplankters to pollution under reservoir conditions are defined. Zooplankters are a fairly representative indicator of the saprobic state of reservoir water quality. Polluted zones are determined on the basis of saprobic indices, species distribution in the zooplankton, and variations of zooplankter abundance, which tend to reflect sensitivity to pollution. The substitution, in the Pantle-Buck equation, of the quantity h (which expreses the nominal abundance of a species) by the quantity n (its actual abundance in the sample) eliminates the subjectivity of the nominal estimate. (Deal-EIS)
W80-04716

ACUTE RESIDUAL TOXICITY OF SEVERAL DISINFECTANTS IN DOMESTIC AND INDUSTRIAL WASTE WATER,
Grand Valley State Colleges, Allendale, MI. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-04717

EFFECTS OF AMMONIA AND AMMONIUM ON TOLERANCE AND BYSSOGENESIS IN PERNA VIRIDIS,
Fisheries Coll., Mangalore (India).
N. A. Reddy, and N. R. Menon.
Marine Ecology-Progress Series, Vol 1, p 315-321, 1979. 7 Fig, 7 Tab, 11 Ref.

Descriptors: *Toxicity, *Mussels, *Ammonia, Ammonium compounds, Lethal limit, Mortality, Bioassay, Animal pathology, Animal physiology, Growth rates, Nitrogen compounds, Water chemistry, Hydrogen ion concentration, *Perna.

Individuals of the commercially important green mussel Perna viridis were exposed to different concentrations of ammonia (NH_3) and ammonium (NH_4^+), to determine their reactions with reference to tolerance and byssogenesis. Eight concentrations of ammonia, ranging from 2.75 to 33.00 mg/l, and 7 concentrations of ammonium, ranging from 5.00 to 75.00 mg/l, were tested. Young individuals in the size range 20 to 24 mm shell length, collected from an unpolluted rocky shore, were used as test organisms. The 96-h lethal concentration causing 50% mortality (LC 50) was 7.60 mg/l for NH_3 and 13.00 mg/l for NH_4^+. For ammonia, the difference between LC 50 values at 48 and at 96 h is drastic. In sublethal concentrations P. viridis retarded or suspended pedal-gland activity. A sharp reduction in the number of threads produced occurs at 5.50 and 8.25 mg/l of ammonia. At higher concentrations the byssus threads secreted displayed reduced rates of tanning and hardening. The difference in the number of byssus threads produced at various ammonia concentration was highly significant. Compared to controls the discs developed at the tips of the byssus threads did not possess normal adhesive properties. (Deal-EIS)
W80-04721

ACUTE TOXICITY OF HEAVY METALS TO AQUATIC INVERTEBRATES AT DIFFERENT TEMPERATURES,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W80-04723

A COMPARISON OF TOLERANCE TO PHENOL EXHIBITED BY AQUATIC INSECTS AND ARACHNIDA DURING ONTOGENESIS,
Institute of Ecological Toxicology, Baykal (USSR).
V. A. Alekseyev.
Hydrobiological Journal, Vol 14, No 6, p 83-89, 1978. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Phenols, *Toxicity, *Aquatic insects, *Diptera, Bioassay, Growth stages, Reproduction, Larval growth stages, Animal growth, Mode of action, Water chemistry, Mortality, Animal physiology, *Arachnida.

The effect of phenol on reproduction and development of water insects and Arachnida is traced. Resistance was studied in 23 species at different stages of metamorphosis. Small concentrations of phenol to stimulate reproduction and development (the order of oviposition is more distinct, larvae and imago hatching is more complete even as compared with the control, periods of metamorphosis are shortened): in more toxic solutions oviposition is irregular, periods of oviposition and larvae and imago hatching become longer. When concentrations are high, the loss of eggs and subsequent stages increases. Resistance at different stages of ontogenesis is shown to be determined by morphology, behavior and ecology. (Deal-EIS)
W80-04724

ZOOPLANKTON ECOLOGY AND POLLUTION STUDIES,
Polytechnic of the South Bank, London (England). Dept. of Applied Biology.
M. P. Tevlin, and M. J. Burgis.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 19-38, 1978. 8 Fig, 108 Ref.

Descriptors: *Zooplankton, *Bioindicators, *Daphnia, Food webs, Crustaceans, Water quality standards, Water chemistry, Bioassay, Toxicity, Methodology, Monitoring, Growth rates, Animal physiology, Cadmium.

Zooplankton organisms occupy a central position in the food webs of aquatic ecosystems. This, plus their sensitivity to environmental factors, both natural and artificial, makes the Cladocera, particularly species of Daphnia, of considerable significance to pollution studies. They are especially useful in the detection of low levels of toxins and this is illustrated by a brief outline of the historical development of pollution studies using biological indicators. Since the effects of pollutants on these organisms can only be assessed when the effects of natural environmental variation are taken into account, the complexities of natural population responses to environmental factors are reviewed. Pollution effects are discussed with reference to studies involving natural communities and laboratory assay procedures. (Deal-EIS)
W80-04725

SYSTEMS OF BIOLOGICAL INDICATORS FOR WATER QUALITY ASSESSMENT,
Laboratory for Biological Research in Aquatic Pollution, Ghent (Belgium).
G. Persoone, and N. DePauw.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 39-75, 1978. 13 Fig, 9 Tab, 53 Ref.

Descriptors: *Bioindicators, *Water quality, *Methodology, Monitoring, Water quality control, Water quality standards, Trophic level, Productivity, Biological communities, Aquatic populations, Dominant organisms, Oligotrophy, Mesotrophy, Statistical analysis, *Species diversity, *Diversity indices.

The paper reviews and comments on the major methods which have been worked out at the international level for the assessment of the quality of surface waters with the aid of biological-ecological criteria. The endeavours of the Commission of the European Economic Communities aiming at the intercalibration of methods used in different countries, and the trends which emerged from recent exercises carried out in different hydrographic basins are outlined briefly. (Deal-EIS)
W80-04727

ACIDITY AND SPECIES DIVERSITY IN FRESHWATER CRUSTACEAN FAUNAS,
Freshwater Biological Association, Windermere (England).
For primary bibliographic entry see Field 5A.
W80-04731

A COMPARISON OF POPULATIONS OF THE ISOPOD ASELLUS AQUATICUS ABOVE AND BELOW POWER STATIONS IN ORGANICALLY POLLUTED REACHES OF THE RIVER TRENT,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
R. J. Aston, and A. G. P. Milner.
Freshwater Biology, Vol 10, p 1-14, 1980. 7 Fig, 5 Tab, 14 Ref.

Descriptors: *Isopods, *Powerplants, *Toxicity, *Aquatic populations, Water temperature, Life history studies, Invertebrates, Biomass, Heated water, Thermal pollution, Seasonal, Growth stages, River Trent, Water pollution effects.

Five populations of Asellus aquaticus, subjected to different combinations of temperature and organic pollution in the River Trent, were examined over a period of 18 months. The life-cycle was probably completed in a year or less in all the populations sampled, a larger proportion of the animals completing the life-cycle in less than a year at warmer locations. Young animals also hatched 1 or 2 months earlier at the warmer locations. At the locations subjected to most organic pollution, population densities and the size of animals of both sexes were the largest. The size of ovigerous females, however, appeared to be inversely related to temperature, the smallest occurring at the warmest location. Possible explanations for these differences are given in terms of the amount of food available and the effect of temperature on growth and sexual maturation. (Deal-EIS)
W80-04732

OSMOTIC RESPONSES OF EGGS AND LARVAE OF THE PACIFIC HERRING TO SALINITY AND CADMIUM,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5B.
W80-04733

RADIOACTIVE CONTAMINATION OF THE AQUATIC FOOD-CHAIN AND CONSEQUENT RISK TO MAN,
Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Div. Protezione Ambiente.
A. A. Cigna.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 163-177, 1978. 2 Ref.

Descriptors: *Food chains, *Public health, *Radioisotopes, Radiation, Radioactivity effects, Radioecology, Radiosensitivity, Radiochemical analysis, Chemical properties, Sedimentation, Path of pollutants, Water quality standards, Radioactive wastes.

The extreme caution adopted to keep any radioactive contamination within safe and severe limits implies that any component of the environment is protected from possible harmful effects, considering that man is among the organisms most sensitive to radiation. The general criteria of radiation protection lead to the fixation of the quantity of radioactive substances which can be discharged into an environment. This quantity is usually expressed in a so called 'discharge formula'. Many difficult problems are involved in the determination of such a formula: characteristics of environmental media, various phenomena which may modify the distribution of radioactivity and all factors which influence the exposure of man to radiation. All these factors must be evaluated against the general re-

quirement of public health and of economical feasibility. Only a fraction of the limiting environmental capacities will eventually be utilized for the effective discharge of radioactive wastes into the environment. Within this fraction the contribution of each radionuclide species is defined relative to the contribution of all other species. (Deal-EIS)
W80-04734

THE EFFECTS OF ACCLIMATION ON THE SALINITY TOLERANCE OF GRASS CARP, CTENOPHARYNGODON IDELLA (CUV. AND VAL.),
Arkansas Univ., Fayetteville. Dept. of Zoology.
R. V. Kilambi, and A. Zdinak.
Journal of Fish Biology, Vol 16, p 171-175, 1980. 3 Tab, 9 Ref.

Descriptors: *Salt tolerance, *Carp, *Adaptation, Grass carp, Salinity, Water chemistry, Fish physiology, Animal metabolism, Toxicity, Mortality, Freshwater fish, Lethal limit, Weight, Ctenopharyngodon, *Acclimation, Salinity tolerance.

Grass carp acclimated to 3, 5, 7, and 9 o/oo salinities were tested for salinity tolerance. The upper tolerance limit (LS50) for 3 and 5 o/oo, and 7 o/oo acclimated fish were 14.2 and 14.0 o/oo, respectively. Fish acclimated to 9 o/oo had a 50% mortality at an estimated salinity of 16.0%, for 24h exposure. Weight losses for the 3 and 5 o/oo acclimated fish were significantly lower than for those acclimated to 9 o/oo. (Deal-EIS)
W80-04735

CADMIUM TOXICITY TO THREE SPECIES OF ESTUARINE INVERTEBRATES,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-04736

THE COMBINED EFFECT OF SALINITY, TEMPERATURE AND OIL ON THE GROWTH PATTERN OF EMBRYOS OF THE KILLIFISH, FUNDULUS HETEROCLITUS WALBAUM,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-04737

LIVER CADMIUM UPTAKE, CATALASE INHIBITION AND CADMIUM THIONEIN PRODUCTION IN THE KILLIFISH (FUNDULUS HETEROCLITUS) INDUCED BY EXPERIMENTAL CADMIUM EXPOSURE,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-04738

KEPONE EFFECTS ON LARVAL DEVELOPMENT OF MUD-CRAB AND BLUE-CRAB,
Duke Univ., Durham, NC. Dept. of Zoology.
C. G. Bookhout, J. D. Costlow, Jr., and R. Monroe.
Water, Air, and Soil Pollution, Vol 13, p 57-77, 1980. 7 Fig, 6 Tab, 27 Ref.

Descriptors: *Pesticide toxicity, *Larval growth stage, *Crabs, Mortality, Lethal limit, Bioassay, Growth stages, Chlorinated hydrocarbon pesticides, Growth rates, Crustaceans, *Kepone.

Laboratory experiments were conducted to determine the effects of Kepone on the larval development of the mud-crab, Rhithropanopeus harrisii, and the commercial blue crab, Callinectes sapidus, from the time of hatching until the first crab stage was reached. Differential survival of R. harrisii from hatching to first crab stage occurred in a range of 35 to 125 ppb Kepone, whereas differential survival of C. sapidus over the same period of development occurred in a range of 0.1 to 1.0 ppb. Statistical analysis indicated that, for every 10 ppb Kepone added, duration from hatching to first crab stage of R. harrisii was increased by 0.391 + or - 0.043 days; whereas for each increase of 0.1 ppb, the duration from hatching to first crab stage of C. sapidus is prolonged by 0.38 + or - 0.10 days. The first and second zoeal stages of R. harrisii were the most sensitive developmental stages to Kepone, but the first zoeal stage of C. sapidus was not sensitive, statistically, to any concentration of Kepone tested. In zoeal stages II, III and IV, there were significant increases in mortality of C. sapidus over the previous stage in all media tested. (Deal-EIS)
W80-04739

A MARINE ALGAL BIOASSAY METHOD: RESULTS WITH PESTICIDES AND INDUSTRIAL WASTES,
Environmental Research Labs., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-04740

THE USE OF ISAZA (CHAENOGOBIUS ISAZA TANAKA) TO STUDY THE PCB POLLUTION (IN JAPANESE),
Kobe Shoka Daigaku (Japan).
N. Watanabe, Y. Ishimaru, N. Ishida, Y. Katayama, and S. Kitayama.
The Japanese Journal of Limnology, Vol 40, No 2, p 66-73, 1979. 6 Fig, 1 Tab, 16 Ref. (English abstract).

Descriptors: *Polychlorinated biphenyls, *Pesticide residues, *Chemical wastes, Industrial wastes, Chemical analysis, Gas chromatography, Animal metabolism, Lakes, Lipids, Pesticide kinetics, Lake Biwa, Japan, Chaenogobins, *Japan, *Tissue analysis.

Polychlorinated biphenyls (PCBs) have been used in industry since 1954. Around Lake Biwa, 16 factories used such materials, and they were detected in many environmental samples from the lake. In this study, the PCB concentration was determined by gas-chromatography in Isaza, in the northern part of Lake Biwa. PCB residues were found in all the samples collected from 1966 to 1976, and the concentrations ranged from 0.413 to 1.53 ppm. PCB residues in Isaza aged 1 are higher than those in Isaza aged 0, and the differences is significant. This difference is thought to be related to the difference of their fat contents. The ratio of highly chlorinated PCB to the total PCB residue in Isaza aged 1 is significantly higher than that in Isaza aged 0. The reason seems to be that low chlorinated PCBs are more easily metabolized than highly chlorinated PCBs. PCB residues in Isaza do not show much decrease even after PCB production was stopped in 1972. (Deal-EIS)
W80-04741

CHLOROTIC DEATH OF LEMNA GIBBA BY CADMIUM IN DIFFERENT CONCENTRATIONS OF NUTRITIONAL MINERALS (IN JAPANESE),
Tokyo Univ. of Agriculture and Technology (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 5A.
W80-04742

RESPONSES OF SALT MARSH VEGETATION TO OIL SPILLS AND REFINERY EFFLUENTS,
Field Studies Council, Pembroke (Wales). Oil Pollution Research Unit.
J. M. Baker.
In: Ecological Processes in Coastal Environments, R. L. Jefferies and A. J. Davy, Eds., Blackwell Scientific Publications, Oxford, p 529-542, 1977. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Oil spills, *Toxicity, *Salt marshes, *Aquatic plants, Oil, Oil pollution, Plant physiology, Mode of action, Plant pathology, Plant populations, Dominant organisms, Plant growth, Salt marsh plants, *Crude oil.

Salt marsh plants show a wide range of susceptibility to typical crude oils, ranging from annuals such as Salicornia spp. which are killed by one oiling, to Oenanthe lachenalii which withstands 12 successive monthly applications of fresh Kuwait crude oil. Spartina anglica survives most single oil spillages well but does not tolerate chronic pollution. Experimental evidence suggests that oil inteferes with the normal oxygen diffusion process down the plants into the roots. Competitive advantages are gained by tolerant species following oiling. This is particularly striking in the upper salt marsh community studied, where the susceptible Juncus maritimus was replaced by Oenanthe and by Agrostis stolonifera. Marsh cleaning methods (burning, cutting or treatment with chemical dispersants) do not appear to decrease the damage done by oil pollution, and often increase it. Different crude oils and products vary considerably in their toxicity. Light aromatics appear to be the greatest contributor to acute toxicity. Some heavy or weathered oils stimulate the growth of salt marsh plants. (Deal-EIS)
W80-04743

PREDICTED CORROSION AND SCALE-FORMATION PROPERTIES OF GEOPRESSURED GEOTHERMAL WATERS FROM THE NORTHERN GULF OF MEXICO BASIN,
For primary bibliographic entry see Field 2K.
W80-04766

THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978: BALANCING ENERGY NEEDS WITH ENVIRONMENTAL CONCERNS,
For primary bibliographic entry see Field 6E.
W80-04793

5D. Waste Treatment Processes

PHOSPHATE REMOVAL FROM INDUSTRIAL AND MUNICIPAL WASTEWATER,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
R. C. Ahlert, M. L. Granstrom, and M. A. Slam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173958, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute, Rutgers University, Final Technical Completion Report, April 1980. 7 p. OWRT-A-052-NJ(1), 14-34-0001-9032.

Descriptors: *Phosphorus, Phosphates, Treatment, Waste water treatment, Industrial wastes, Municipal wastes, Evaluation, Methodology, Chemical precipitation, Nutrients, Sewage treatment, Phosphorus removal.

Phosphorus removal was evaluated at several points in a conventional wastewater treatment process. Samples were taken from a secondary plant utilizing a high rate trickling filter on municipal wastewater. Treatment of settled primary effluent, secondary effluent and settled secondary effluent was considered. The experimental matrix included ferric ion dosage and pH level. Sampling points were selected to highlight process variables of interest. These included organic carbon content and unsettled solids content. In all cases, phosphorus removal was substantially less than predicted from pure species solubility data. In addition, the effect of unsettled or unsettleable solids is marked. In all experiments, comparisons of removal efficiency were made for filtered and unfiltered portions of process samples. Beyond the obvious effects of cation dosage and pH, the nature and concentration of particulate matter appear to be important treatment variables.
W80-04543

WATER INTAKE, WASTEWATER PRODUCTION AND TREATMENT, AND AIR POLLUTION CONTROL IN COAL-FIRED STEAM-ELECTRIC POWER GENERATING STATIONS.
CH2M/Hill Ltd., Ottawa (Ontario).
Water Pollution Control Directorate, Ottawa, Ontario, Canada, Environmental Protection Service. Report No EPS 3-WP-80-1, 1980. 145 p, 32 Fig, 33 Tab, 29 Ref.

Descriptors: *Baseline studies, *Emission standards, *Air pollution, *Water pollution, Particulate removal, Flue gas desulphurization, Solid waste disposal, Water management, Costs, Waste disposal, Power plants, Electricity.

Basic air and water emission requirements, and power plant design and operating characteristics are defined. Air pollution control particulate removal devices and a variety of flue gas desulphurization (FGD) alternatives are compared in terms of economic and technical applicability, water requirements, water consumption, and liquid and solid wastes production during power station operation with different types of coal. Three possible station water management systems (once-through, recirculation with limited discharge, and zero discharge) are evaluated under selected conditions, and their impacts on water intake, consumption and wastewater treatment are compared in detail. Coal type is shown to have a strong influence on the quantities of wastes produced and type of air pollution control devices which may be used. In turn, the types of control devices selected are also shown to affect the nature of subsequent wastewater and solid wastes problems. Wastewater recirculation and re-use designs incorporated into station water use related to air pollution controls are found useful in reducing water consumption and wastewater production and treatment requirements. (WATDOC)
W80-04565

EVALUATION OF INDUSTRIAL WASTE CARBON SOURCES FOR BIOLOGICAL DENITRIFICATION,
Environmental Protection Service, Ottawa (Ontario). Water Technology Centre.
H. D. Monteith, T. R. Bridle, and P. M. Sutton.
Report No EPS 4-WP-79-9, 1979. 71 p, 8 Fig, 8 Tab, 16 Ref, 3 App.

Descriptors: *Biological denitrification, *Industrial wastes, Substrate consumption, Waste characterization, Oxygen demand, Organic carbon, Nitrogen, Methanol.

Concern over impairment of water quality by both industrial and municipal effluents has resulted in extensive investigations into nitrogen removal processes. Biological dentrification is one of the most economical and effective means of nitrate reduction. The process involves the conversion of nitrate to dinitrogen (N2) using organic carbon as the electron donor. Methanol appears to be the most popular electron donor. Although methanol has certain advantages, its significant disadvantage is cost and this alone justifies consideration of alternative electron donors. A project was initiated to identify and evaluate industrial wastes or waste by-products which could be used as replacements for methanol. Forty-one waste samples were collected and chemically analyzed to determine their organic carbon and nitrogen concentrations. Bench scale testing followed, with the determination of batch denitrification rates for 30 of the characterized wastewaters. Twenty-seven of the 30 wastes exhibited denitrification rates equal to or greater than that observed using methanol. Many of the wastes exhibited substrate consumption ratios equal to or less than that for methanol. Data analysis showed a correlation between the initial FOC:N ratio and substrate consumption ratio. Evaluation of costs for transportation of waste carbon sources by truck are compared to methanol disposal. (WATDOC)
W80-04569

ENVIRONMENTAL LAW (RESOURCE UTILIZATION, WATER POLLUTION AND AIR POLLUTION),
For primary bibliographic entry see Field 6E.
W80-04582

THE EFFECT OF WATER PRETREATMENT CHEMICALS ON THE PERFORMANCE AND DURABILITY OF REVERSE OSMOSIS MEMBRANES,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 3A.
W80-04596

BIODEGRADATION OF THIOCYANATE BY MICROORGANISMS ISOLATED FROM GAS LIQUOR,
North Dakota State Univ., Fargo. Dept. of Biochemistry.
J. A. Fleeker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175029, Price codes: A03 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University, Research Project Technical Termination Report, November 1978. p 26, 6 Fig, 2 Tab, 24 Ref. OWRT A-054-NDAK(1).

Descriptors: *Biodegradation, *Bacteria, *Microbial degradation, *Waste water treatment, Coals, Soil microbiology, Cultures, Microorganisms, Soil bacteria, Tracers, Spectrophotometry, Chromatography, Analytical techniques, Arthrobacter, Thiocyanate.

Enrichment culture techniques were used to isolate an Arthrobacter species capable of using thiocyanate as a nitrogen source. Thiocyanate, a pollution indicator, is found in waste waters from coal gasification and coke production. Two enrichment media were used, a carboxylic acid-mineral medium (CM) and a glucose-mineral medium (GM); both were successful in producing isolates. The colony studied was isolated from a soil sample taken adjacent to a railroad bank and was isolated with the GM enrichment medium. The Arthrobacter isolated is gram-positive, heterotrophic, polymorphic, and grows in salmon-colored, opaque colonies. It is able to grow on alcohols, amines, carbohydrates, and acids. The Arthrobacter can degrade thiocyanate even in the presence of ammonium or nitrate ions. It tolerates thiocyanate in concentrations up to 0.1M. Analytical methods used include spectrophotometry, paper chromatography, quanine-cytosine content analysis, and radioisotopic analysis. Radioactive thiocyanate and the release of radioactive C02 were used to monitor decomposition rates. Results show that thiocyanate degradation falls to low levels as growth approaches the stationary phase. Unsuccessful attempts were made to produce a cell-free extract of the Arthrobacter that could chemically change thiocyanate. (Seigler-IPA)
W80-04605

IRRIGATION RETURN FLOW TREATMENT BY BIOLOGICAL DENITRIFICATION PROCESS FOR NITRATE REMOVAL,
North Dakota Univ., Grand Forks. Dept. of Civil Engineering.
Y. T. Hung, and G. O. Fossum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175318, Price codes: A06 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University, Fargo Research Project Technical Completion Report, September 1979. p 102, 18 Fig, 41 Tab, 10 Ref. OWRT A-058-NDAK(1).

Descriptors: *Denitrification, *Anaerobic bacteria, *Biological treatment, *Water purification, *Irrigation water, Nitrates, Nutrient removal, Potable water, Reclaimed water, Water quality, Biodegradation, Waste water treatment, Eutrophication.

Anaerobic upflow continuous biological filters were used to remove excessive nitrate-nitrogen (N03-N) from irrigation return flows which typically contain high concentrations of N03-N. A maximum N03-N level of 10 mg/l in drinking water is specified by national regulations. For the study synthetic irrigation return flow was used composed of water from the Water Treatment Plant at Grand Forks, North Dakota, supplemented with various concentrations of sodium nitrate and methanol. Anaerobic bacteria from settled sludge from the Water Treatment Plant were acclimated in a batch reactor for two months. For the filters, three columns were constructed of clear lexan polycarbonate to a height of 6 ft with a 3 in inside diameter. Feed concentrations were varied from 5 to 100 mg/l N03-N and methanol to N03-N ratios ranged from 0.5 to 3.0. Various hydraulic loading rates tested ranged from 132 to 1,222 gpd/sq ft. Results show that the filters are a feasible method of denitrification of irrigation return flow. For a feed of 40 mg/l or less of N03-N, a 2 ft column produced acceptable water with 10 mg/l or less N03-N. Results are given for other combinations of feed concentration, methanol concentration, and loading rates. The deterioration of nitrate samples were also investigated with respect to storage time and chemical preservation of feed water. (Seigler-IPA)
W80-04610

RADIO-MANGANESE, -IRON, AND -PHOSPHORUS UPTAKE BY WATER HYACINTH AND ECONOMIC IMPLICATIONS,
University of South Florida, Tampa.
For primary bibliographic entry see Field 2I.
W80-04649

NUTRITIONAL COMPOSITION OF WATER HYACINTHS GROWN ON DOMESTIC SEWAGE,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 4A.
W80-04660

THE EFFECT OF SEWAGE EFFLUENT ON THE STRUCTURE AND FUNCTION OF A FRESHWATER TIDAL MARSH ECOSYSTEM,
Rider Coll., Trenton, NJ. Dept. of Biology.
D. F. Whigham, R. L. Simpson, and K. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176100, Price codes: A08 in paper copy, A01 in microfiche. New Jersey Water Resources Research Institute, Rutgers University, New Brunswick. Final Technical Completion Report, February, 1980. 160 p, 23 Fig, 82 Tab, 56 Ref. OWRT B-060-NJ(4), 14-34-0001-6099.

Descriptors: *Nutrient removal, *Sewage treatment, *Tidal marshes, *Freshwater marshes, *Marsh plants, Soil algae, Litter, Decomposing organic matter, Primary productivity, Chlorophyll, Dissolved oxygen, Carbon dioxide, Nitrogen, Phosphorus, Soil, Water pollution control, Waste assimilative capacity, Biomass, Chlorophyta, Chrysophyta, Euglenophyta, Cyanophyta, Nitrates, Nitrites, Ammonia, Delaware River, *Hamilton marshes(NJ), New Jersey.

The effects of spraying chlorinated secondarily treated sewage on a Delaware River freshwater tidal wetland for three years was studied. Macrophyte net primary production was significantly lower in the experimental sites receiving sewage than in the no treatment controls in 1975 but not in 1976 or 1977. Diversity of annuals was reduced in the experimental sites largely due to the elimination of annuals. Although percent N and P were generally high in the vegetation of experimental sites, there was little difference in Total N and Total P between treatments and controls. Macrophyte decomposition rates were little affected by sewage application. Substrate N and P were not significantly different between sites, but surface litter of the experimental sites accumulated N and P. Epibenthic algae may contribute to this accumulation. Water quality studies showed the high marsh to be metabolically active. Tide cycle flux studies indicated that up to 40% of the N added to the wetland was assimilated during the late spring - early summer period. Conversely, there was a net loss of P from the wetland. These results are compared with those of similar studies in other wetlands. It is concluded that the strongly pulsed tidal regimes of the wetland, the low organic content substrate, and the eutrophic nature of Delaware River waters contribute to the inability of the wetland to efficiently assimilate nutrients from sewage.
W80-04674

RESPONSE OF BIOLOGICAL REACTORS TO THE ADDITION OF POWERED ACTIVATED CARBON,
Connecticut Univ., Storrs. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W80-04680

GLYCERIA MAXIMA (HARTM.) HOLMB. IN PONDS SUPPLIED WITH POST-SEWAGE WATER,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
T. Ozimek, and L. Klekot.
Aquatic Botany, Vol 7, p 231-239, 1979. 1 Fig, 4 Tab, 18 Ref.

Descriptors: *Aquatic plants, *Waste treatment, *Growth rates, Municipal wastes, Domestic wastes, Industrial wastes, Nutrients, Plant growth, Biomass, Nitrogen, Phosphorus, Potassium, Water chemistry, *Glyceria.

Glyceria maxima growing in a pond supplied with post-sewage water (sewage after biological and mechanical treatment) grows very well, attaining a high biomass of 1.5 kg dry weight/sq. m. of an overgrown surface, and accumulating large amounts of different elements, e.g. 46.2 g N, 7.9 g P and 31.1 g K/kg dry weight of plants. The plant offers possibilities for the purification of waters polluted by municipal and industrial waste. (Deal-EIS)
W80-04730

INTERCEPTOR SEWERS AND URBAN SPRAWL,
Urban Systems Research and Engineering, Inc., Cambridge, MA.
C. Binkley, B. Collins, L. Kanter, M. Alford, and M. Shapiro.
Lexington Books, Lexington, MA. 1975. 120 p.

Descriptors: *Water quality, *Sewage systems, *Interceptor sewers, *Conveyance structures, *Sewers, *Urban land use, *Urban impact, *Urbanization, Water quality management(Applied), Sewage, Urban drainage, Social aspects, Project design, Environmental effects, Public participation, Cost-benefit analysis, Mathematical studies, Costs, Capacity, Flow rates.

This book is based on a study which was undertaken to analyze the relationship of urban growth and the federal sewer grant program. Recent interceptor projects financed by U.S. Environmental Protection Agency grants are examined to determine how they affect residential development in the areas where they are built. Alternative methods of interceptor financing with important land use implications include withholding of funds unless certain land use objectives are met, changing the grant formula, and limiting or curtailing funding of reserve capacity. Eight case studies were undertaken to determine which of the policies would work best under varying conditions; summaries are presented for four. Interceptor design and its relation to land use are discussed. An overview of the size and scope of projects in the study sample is presented. Factors influencing interceptor costs are discussed and data obtained in the study are analyzed. Excess capacity built into the interceptors sampled averaged $145 per capita, with costs as high as $658 per capita occurring. Interceptor staging policies are analyzed to pinpoint no Federal funds for excess capacity; reevaluation of interceptor staging of project design in rapidly growing areas; using realistic standards for per capita flow; improving population forecasting techniques and review procedures; requiring consideration of environmental effects of interceptor-induced land use; and increasing public participation in the planning process by publicizing community costs and benefits of interceptor-induced growth. (Arnold-NC)
W80-04751

DESIGN OF WASTEWATER TREATMENT FACILITIES, MAJOR SYSTEMS.
Office of the Chief of Engineers (Army), Washington, DC.
For primary bibliographic entry see Field 8A.
W80-04773

FEDERAL ENVIRONMENTAL LITIGATION IN 1976: THE FEDERAL WATER POLLUTION CONTROL ACT,
For primary bibliographic entry see Field 6E.
W80-04783

5E. Ultimate Disposal Of Wastes

BOREHOLE GEOPHYSICS AS APPLIED TO THE MANAGEMENT OF RADIOACTIVE WASTE -- SITE SELECTION AND MONITORING,
Geological Survey, Denver, CO. Water Resources Div.
W. S. Keys, D. E. Eggers, and T. A. Taylor.
In: Management of Low-Level Radioactive Waste, Carter, M.W., and others, eds: New York Pergamon Press, Inc., Elmsford, p 955-982, 1979. 7 Fig, 3 Tab, 25 Ref.

Descriptors: *Borehole geophysics, *Radioactive wastes, *Waste disposal wells, *Injection wells, Sites, Monitoring, Borehole cameras, Radioactive well logging, Subsurface investigations.

The U.S. Geological Survey is conducting research on borehole geophysics, including the application of well logging to the investigation of radioactive waste disposal sites. During the past 14 years, eight such sites have been studied. Geophysical well logging provides in situ measuring techniques which can be used to supplement conventional coring and water sampling techniques in both site-selection studies and in the monitoring of operating disposal sites. Some of the advantages of well logging over conventional techniques include the relatively large volume of rock that can be investigated and the ability to measure temporal changes. Logging also reduces the amount of expensive coring required. Logs provide a continuous record of data that can be correlated from hole to hole. Data from geophysical logs can be interpreted in terms of lithology, elastic moduli, bulk density, porosity, moisture content, water quality, and the location and orientation of fractures. Fracture permeability can provide avenues for rapid water movement. After a site is in use, borehole geophysics provides a means to monitor changes in moisture content, water level, and radionuclide concentration in either cased or open holes. Water samples usually provide data only on the permeable intervals below the water table. Gamma spectral logging techniques provide data for any point in the well in relation to vertical and lateral distribution of contaminants. Radionuclides that have migrated from several operating sites have been identified. Detection limits on the order of 0.2 picocuries per gram have been attained for 60Co and 137Cs. A number of other gamma-emitting radioisotopes can be identified using inhole gamma spectrometry. (Kosco-USGS)
W80-04561

THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 - THE NEWEST ENVIRONMENTAL 'SLEEPER'.
American Bar Association, Washington, DC. Committee on Environmental Controls.
For primary bibliographic entry see Field 6E.
W80-04575

5F. Water Treatment and Quality Alteration

DESIGN OF WASTEWATER TREATMENT FACILITIES, MAJOR SYSTEMS.
Office of the Chief of Engineers (Army), Washington, DC.
For primary bibliographic entry see Field 8A.
W80-04773

THE MUNICIPAL PROGRAM OF THE CLEAN WATER ACT: 1978 ADMINISTRATIVE IMPLEMENTATION,
For primary bibliographic entry see Field 6E.
W80-04797

5G. Water Quality Control

PREVENT GROUND WATER CONTAMINATION BEFORE IT'S TOO LATE,
Camp, Dresser and McKee, Boston, MA.
For primary bibliographic entry see Field 5B.
W80-04666

GROUND WATER VS. HAZARDOUS WASTES,
National Water Well Association, Worthington, OH.
T. C. Gass.
Water Well Journal, Vol 34, No 2, p 38-39, February, 1980. 2 Fig.

Descriptors: *Ground water, *Water pollution control, *Waste disposal, Hazards, Attenuation, Absorption, Waste dilution, Dispersion, Path of pollutants, Persistence, Regulations, Law enforcement, Legislation.

Ground water contamination by hazardous wastes can occur through poorly-designed landfills, industrial liquid waste impoundments, and underground contaminant facilities. Contaminants in ground water tend to be removed or reduced with time and distance by adsorption, dilution and dispersion. Contaminants form a plume, the shape and size of which depend upon local geology, ground water flow, type and concentration of contaminants, continuity of waste disposal and any man-made changes such as well pumping. Ground water contamination may persist for years if a contaminant is not readily absorbed or degraded. Local, state and federal governments help protect ground water resources by promulgating and enforcing hazardous waste disposal regulations. The Safe Drinking Water Act, Resource Conservation and Recovery Act, and Toxic Substances Control Act are examples of federal legislation which have provisions for ground water protection. (Purdin-NWWA)
W80-04675

WATER USE AND SUPPLY DEVELOPMENT PLAN--EXECUTIVE SUMMARY.
South Florida Water Management District, West Palm Beach.
For primary bibliographic entry see Field 4A.
W80-04746

INTERCEPTOR SEWERS AND URBAN SPRAWL,
Urban Systems Research and Engineering, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5D.
W80-04751

HYDROLOGY RESEARCH DIVISION--ANNUAL PROGRESS REPORTS AND SHORT RESEARCH NOTES 1977-78.
Department of Fisheries and Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 10C.
W80-04753

STANLY COUNTY FEASIBILITY REPORT FOR ON-SITE WASTEWATER SYSTEMS MANAGEMENT: PHASE I,
Stanly County Health Dept., Albemarle, NC.
B. R. Gray, S. C. Grayson, J. P. Straley, B. L. Kays, and B. L. Carlile.
(1979). 108 p, 11 Fig, 15 Tab, 5 Append. P004198013.

Descriptors: *Waste water treatment, *Water quality, *Surface waters, *Subsurface waters, *Stanly County(NC), *Water management(Applied), Waste water(Drainage), Water treatment, Waste water disposal, Septic tanks, Administrative costs, Maintenance costs.

The authors discuss a three month study of the feasibility of Stanly County, NC, providing management of its own on-site wastewater disposal system in practical, legal, technical, political and financial terms. A county managed system was determined necessary to protect adequately the area's surface and subsurface water quality. The investigation included aerial infrared photography surveillance, in which approximately 2,000 homes were surveyed for surfacing sewage effluents, with problems detected around 40% of the dwellings, and system failures discovered in 12%. The county

has inherent problems in the design of ground absorption sewage disposal systems due to its soil types. Hydraulic conductivity studies were undertaken at selected sites based on type of subsoil and the amount of that soil across the county. Guidelines are presented for alternative pressure systems and for tanks, pumps, controls, and drainfields for low pressure home sewerage systems. An economic analysis was undertaken to determine financial feasibility. Various elements of the cost included an initial sinking (or contingency) fund, regular maintenance costs and administrative costs, and financing of system improvement to cover costs of renovation. The number of customers would have a major influence on monthly costs to individual customers. Areas for study in Phase II of the project include education of local officials and the public in water quality management needs, finding further methods of financing the overall program, and effecting amendments in the Federal 201 facilities plan so that more dollars will be available for water quality management. (Arnold-NC)
W80-04771

SOIL CONSERVATION AND WATER POLLUTION CONTROL: THE MUDDY RECORD OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
Nebraska Univ., Omaha.
For primary bibliographic entry see Field 6E.
W80-04791

FEDERAL PROTECTION OF WETLANDS THROUGH LEGAL PROCESS,
For primary bibliographic entry see Field 6E.
W80-04796

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPTIMIZING FLOOD OPERATION RULES,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard, and S. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176639, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No CRWR-166, November 1979. 48 p, 9 Tab, 20 Ref, 1 Append. OWRT B-182-TEX(1).

Descriptors: *Flood control, *Reservoir operation, *Optimization, *Dynamic programming, Computer programs, Computer models, Mathematical models, Flood damage, Peak discharge, Stochastic processes, Reservoir releases, Flood protection, Mississippi, Inflow, Reservoir stages.

Stochastic dynamic programming was used to formulate flood-control reservoir operation rules with provisions for traditional considerations, flood-warning time, and damage increase due to flooding duration. Since future inflows into a given reservoir are not known, all floods of record that followed each classification of system state were taken as representative of all floods to follow that class of system state. The three dimensions of system state are initial reservoir storage, current inflow, and rate of change of inflow. A discussion of dynamic programming formulation for the least-expected-damage reservoir release policy is given along with the traditional release rule. These are coded in the program UTFCO-University of Texas Flood Control Operations. Input preparations and program source listings are provided. The program is illustrated using records for the Pearl River at Jackson, Mississippi, for 1914-1969. Operational rules were developed for a hypothetical reservoir having a flood control capacity of 150,000 acre-feet. The example used is based on daily in flows but the model also applies to complete records of average streamflows for shorter intervals. Program computational costs are about 10 to 40 times the costs of traditional approaches depending on the number of storage levels used. Storage required to compile on a CDC Cyber 170/175 is 62,000 octal and to run 131,000. (Seigler-IPA)
W80-04501

PROBABLE HYDROLOGIC EFFECTS OF A HYPOTHETICAL FAILURE OF MACKAY DAM ON THE BIG LOST RIVER VALLEY FROM MACKAY, IDAHO, TO THE IDAHO NATIONAL ENGINEERING LABORATORY,
Geological Survey, NSTL Station, MS. Water Resources Div.
L. Druffel, G. J. Stiltner, and T. N. Keefer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301175, Price code: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-99, September 1979. 47 p, 20 Fig, 6 Tab, 15 Ref.

Descriptors: *Probability, *Hydrologic budget, *Dam failure, *Model studies, *Idaho, Reservoirs, Analytical techniques, Mathematical models, Flood wave, Discharge(Water), Floodflow, Flood routing, Simulation analysis, Streamflow, Flow rates, Big Lost River Valley(Idaho), Mackay Dam(Idaho).

Mackay Dam is an irrigation reservoir on the Big Lost River, Idaho, approximately 7.2 kilometers northwest of Mackay, Idaho. Consequences of possible rupture of the dam have long concerned the residents of the river valley. The presence of reactors and of a management complex for nuclear wastes on the reservation of the Idaho National Engineering Laboratory (INEL), near the river, give additional cause for concern over the consequences of a rupture of Mackay Dam. The objective of this report is to calculate and route the flood wave resulting from the hypothetical failure of Mackay Dam downstream to the INEL. Both a full and a 50 percent partial breach of this dam are investigated. Two techniques are used to develop the dam-break model. The method of characteristics is used to propagate the shock wave after the dam fails. The linear implicit finite-difference solution is used to route the flood wave after the shock wave has dissipated. The time of travel of the flood wave, duration of flooding, and magnitude of the flood are determined for eight selected sites from Mackay Dam, Idaho, through the INEL diversion. At 4.2 kilometers above the INEL diversion, peak discharges of 1,550.2 and 1,275 cubic meters per second and peak flood elevations of 1,550.3 and 1,550.2 meters were calculated for the full and partial breach, respectively. Flood discharges and flood peaks were not compared for the area downstream of the diversion because of the lack of detailed flood plain geometry. (Kosco-USGS)
W80-04551

REGIONAL DROUGHT AND FLOOD FREQUENCY ANALYSIS: THEORETICAL CONSIDERATION,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol 46, No 3/4, p 265-279, April 1980. 1 Fig, 22 Ref.

Descriptors: *Droughts, *Flood frequency, *Theoretical analysis, Hydrology, Hydrologic data, Floods, Water shortage, Properties, Disasters, Probability, Stochastic processes, *Regional drought, *Flood frequency analysis, Hydrologic phenomena, Normal distribution, Extreme value statistics, Random variables, Water resources systems analysis.

The problems of regional drought and flood analysis were approached theoretically on the basis of random fields. Necessary formulations for the regional drought descriptors such as the deficit area, the total areal deficit, and the maximum deficit intensity were derived. The joint and marginal probability distribution functions of areal drought/flood descriptors were derived for simple cases on the basis of random fields and probability theory. The relationships between expectations of descriptors were explicity furnished which are useful tools in any regional drought and flood assessment. The extreme event probabilities of the whole area covered by a drought were obtained. (Roberts-ISWS)
W80-04618

LEVEL-B MULTIOBJECTIVE PLANNING FOR WATER AND LAND,
Case Western Reserve Univ., Cleveland, OH. Dept. of Systems Engineering.
Y. Y. Haimes, P. Das, and K. Sung.
Journal of the Water Resources Planning and Management Division, Vol 105, No WR2, p 385-401, September 1979. 2 Fig, 2 Tab, 41 Equ, 18 Ref. OWRT C-7047 (No 6221)(7).

Descriptors: *Multiple-purpose projects, *Land use, *Planning, *Water resources, *Maumee River basin(Indiana), *Water pollution, *Model studies, Decision making, Optimization, Cost minimization, Constraints, Environmental quality, Economics, Surrogate Worth Trade-Off Method, Pollution abatement, Point source pollution, Non-point source pollution, Recreation, Waste water treatment, Wild-life habitats, Equations, Systems analysis.

Presented are multiobjective optimization models representing economic development and environmental quality relating to water quality and land use planning. Linear programming is used to derive least-cost point and nonpoint source pollution abatement alternatives, including other related land activities. The environmental quality sector includes the following noncommensurable objectives: (1) soil erosion and sediment control; (2) control of phosphorus discharge from point and nonpoint sources; (3) abatement of biological oxygen-demanding material from point sources; (4) enhancement of land-based recreational opportunities; (5) maintenance of wildlife habitat; and (6) flood control. A trade-offs analysis is carried out using the Surrogate Worth Trade-Off Method. A planning framework is developed for the Maumee River Basin Level-B Study. A recommended plan with its associated trade-off values is presented, and the decision-maker's (Planning Board) role in obtaining a basin-wide plan is discussed. (Bell-Graf-Cornell)
W80-04679

THE GREEN RIVER BASIN ROUTING MODEL,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
H. Yazicigil, A. R. Rao, and G. H. Toebes.
Hydraulics and Systems Engineering, CE-HSE-79-1, 1979. 141 p, 39 Fig, 16 Tab, 20 Ref, 3 Append. DAW 27-74-C-0012.

Descriptors: *Reservoir operation, *River forecasting, *Systems analysis, River management, Reservoir releases, Reservoir storage, *Streamflow forecasting, Model studies, Kentucky, *Green River basin(KY).

Systems analysis techniques are applied to the operation of a series of four flood control reservoirs on the Green River in Kentucky. The reservoir system is regulated by the Louisville District Corps of Engineers. In an earlier report a set of four correlative precipitation-runoff models were built for the watersheds controlled by the reservoirs. A sequel is a larger optimization-simulation model that can be used as an aid in day-to-day operations of the reservoir systems. This includes a streamflow model which can be used to forecast flows in the 'central' part of the Green River Basin; that is, the river system downstream of the outlet works of the four reservoirs. In addition to the model constructed in the study, stochastic models of daily flow series at the Green River outflow station, Calhoun, were developed. The ARMA and AR models were tested as to their performance in forecasting streamflow. Both models performed equally well with one or two day lead times, however their accuracy diminished with time. The model developed for this study GRBSYS2 performed better over time than those mentioned above. (Rao-Purdue)
W80-04744

HYDROLOGY RESEARCH DIVISION--ANNUAL PROGRESS REPORTS AND SHORT RESEARCH NOTES 1977-78.
Department of Fisheries and Environment, Ottawa (Ontario). Water Resources Branch.

For primary bibliographic entry see Field 10C.
W80-04753

MULTI-OBJECTIVE ANALYSIS IN WATER SUPPLY AND MANAGEMENT PROBLEMS FOR A SINGLE RIVER BASIN,
Kobe Univ. (Japan). Dept. of Systems Engineering.
M. Sakawa.
Water Supply and Management, Vol 3, No 1, p 55-64, 1979. 8 Ref, 3 Fig, 2 Tab.

Descriptors: *River basins, *Water supply, *Water management(Applied), *Model studies, *Multi-objective model, *Japan, *Kakogawa River Basin(Japan), *Hyogo Prefecture(Japan), Nonlinear programming, Decision making, Cost assessment, Surrogate Worth Trade-off method, Planning, River basin development, Water resources, Watershed management.

The objective of this study is to develop a multi-objective water supply and management model for a single river basin. The model which is constructed is formulated as a multi-objective nonlinear programming problem. It is assumed that the decision maker's objectives include minimizing total cost associated with construction and operation of the facilities, minimizing pollution and maximizing water supply for the basin. The Surrogate Worth Trade-off method is used to resolve the conflicts between the objectives. For the framework of planning the author assumes that dams are constructed to develop available fresh water in the headwaters of the river basin; industrial and domestic water-conveyance systems between zones are taken into consideration; and in each zone, both fresh and renovated water are utilized, where highly treated water by tertiary treatment plants can be reused for industrial usages only. The model is applied to the study area of the Kakogawa River Basin in Hyogo Prefecture. The solution procedure utilized an epsilon-constraint method using the generalized reduced gradient (GRG) algorithm. In this model in order to obtain the most preferable solution it is important for the decision maker to quantify the preference among the objectives in accordance with the situation of his concern. The author concludes that this model can be applied to other single river basins with some modifications. (Iervolino-NC)
W80-04759

ANALYSIS OF STRUCTURAL AND NON-STRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,
Hydrologic Engineering Center, Davis, CA.
W. K. Johnson, and D. W. Davis.
Training Document No 7, November 1975. 203 p, 26 Fig, 13 Tab, 6 Ref, 1 Append.

Descriptors: *Non-structural alternatives, *Flood control, *Flood plain management, *Analytical techniques, *Cost-benefit analysis, *Fall River(CA), *Planning, Land use, Hydrologic aspects, Stage-discharge relations, Flood discharge, Flood damage, Flood control, Water resources management, Levees, Floodwalls, Reservoirs, Channel improvement, Diversion, Flood forecasting, Floodproofing, Warning systems, Computer programs, Economics, Mathematical models.

The authors illustrate how various flood control measures can be analyzed using the HEC-5C computer program. Basic principles in flood control planning and damage reduction are examined. Flood plain management measures include those designed to control hydrology and those designed to reduce susceptibility of property to damage. Hydrologic and economic relationships are examined and the affects of different types of flood control measures are presented. Of the eight control methods, levees or floodwalls were found to affect the stream's stage-discharge, stage-damage, discharge-damage, and damage frequency relationships. Diversion and flood forecasting affected these relationships the least, but all the methods affected the damage frequency. The HEC-5C program was used to develop systems which maximize net economic benefits. Given an existing system and an array of flood control measures, the strategy proceeds by computing expected annual damages for the existing system; adding any one of the flood control measures and computing expected annual damages; then subtracting expected annual damages with or without the control measure. Finally, the best measure was chosen based upon its final net benefit yield. A final added strategy recomputed costs and benefits by removing one of the control measures to determine if a better net benefit figure would be yielded. The Fall River System of California was used to illustrate how the program functions. (Arnold-NC)
W80-04772

6B. Evaluation Process

MEASURING THE SOCIAL IMPACTS OF WATER RESOURCES PROJECTS,
Kansas Water Resources Research Inst., Manhattan.
C. B. Flynn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173545, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, April 1980. p 21, 7 Fig, 2 Tab. OWRT A-084-KAN(1), 14-34-0001-7035.

Descriptors: *Kansas, *Hillsdale Dam(Kan), *Mud Creek(Kan), Water resources projects, *Social impact, *Construction, *Hydraulic structures, Evaluation, Dependent variables, Independent variables, Quantitative variables, Qualitative variables.

Two water resources projects, the Hillsdale Dam Construction and the Mud Creek Rechannelization, were examined in order to determine whether projects of different sizes produce social impacts of different sizes. The study (1) identified a wide range of social impacts (dependent variables) and those of elements of the projects which affect the magnitude of the impacts (independent variables); (2) defined appropriate geographical impact areas within which changes in the independent variables could be expected to effect changes in the dependent variables; (3) operationalized the variables so that measurements could be obtained for the impact areas; (4) measured the variables for projects in the planning stages; and (5) monitored the variables over time, that is, during and after the construction of the projects. The results indicated that although the quantitative variables monitored did not vary by size of project, the qualitative variables did.
W80-04601

ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04752

A SYSTEMS RESOURCES APPROACH TO CITIZEN PARTICIPATION: THE CASE OF THE CORPS OF ENGINEERS,
North Carolina State Univ. at Raleigh. Dept. of Political Science.
For primary bibliographic entry see Field 6E.
W80-04756

RIVER AMENITY EVALUATION: A REVIEW AND COMMENTARY,
North Central Forest Experiment Station, St. Paul, MN.
E. C. Leatherberry.
Water Resources Bulletin, Vol 15, No 5, p 1281-1292, October 1979. 21 Ref.

Descriptors: *Rivers, *Recreation, *Evaluation, *River resource assessment, *River esthetic assessment, *Benefits, *Assessments, River basin development, River designation, Riparian rights, Wildlife conservation, Classification, Value, Environmental effects, National Wild and Scenic River Act, Preservation.

River amenity evaluation refers to the assessment of features, or conditions, in riparian environments that may provide recreational, or preservational and esthetic values. This report reviews methods of evaluating river amenity values and divides them under three main headings: River Recreation Potential Evaluation, River Esthetic Evaluation and River Preservation Evaluation. Under the first heading the different methods attempt to evaluate recreation potential of rivers by assessing the utility of physical characteristics and other environmental effects for recreation activities. These methods did not adequately represent the dynamic nature of the resource and the potential users. The two methods for evaluating river esthetics had many shortcomings, e.g., they were dependent on the evaluator's personal judgment and photographs were not considered. The evaluation of river esthetics needs to consider what effect people and their impact have on the esthetic quality of the resource. Under the heading of River Preservation Evaluation the methods reviewed are designed to assess the suitability of rivers or river segments for classification in state or federal river preservation programs. The passage of the National Wild and Scenic River Act (PL 90-542) in 1968 instigated the classification of rivers for preservation and recreation purposes. In order to improve the methods they should (1) be capable of identifying and predicting change and its impact on amenity values; (2) incorporate concepts and techniques that measure the dimensions of people's feelings about specific environmental features; and (3) place more emphasis on the quality of the experience to be provided. (Iervolino-NC)
W80-04758

PLANNING UNDEVELOPED LAKESHORE: A CASE STUDY ON LAKE CHAMPLAIN, FERRISBURG, VERMONT,
Vermont Univ., Burlington. Dept. of Agricultural and Resource Economics.
F. O. Sargent, and P. R. Berke.
Water Resources Bulletin, Vol 15, No 3, p 826-837, June 1979. 3 Fig, 7 Ref.

Descriptors: *Water resources planning, *Planning, *Ferrisburg(VT), *Lake Champlain(VT), *Lake shores, *Land management, *Shore protection, *Recreation, *Outdoor recreation, Shores, Lakes, Land development, Land resources, Land conservation, Land use, Public access, Recreation.

Development of private lakeshores usually precedes establishment of public access, resulting in the best access areas being occupied before public access is provided. The authors present an analytical procedure developed to enable planners to classify undeveloped lakeshore areas according to their suitability for public and private uses. The undeveloped lakeshore evaluation system rated the physical characteristics of the lakeshore for five of the most common uses: (1) public beaches; (2) camping and picnicking areas; (3) boat access areas; (4) marinas; and (5) development-vacation homes, cottages, and motels. Standards for rating the lakeshore potential have been developed for the following site requirements: size, slope, soil suitability, shoreline type (sand, rock, muck, or gravel), water quality, site location, scenery, and road access. Each of these items are measured and rated on a numerical scale from 1 to 5; the basis of the rating is a comparison with other sites for a similar use in the town or region. The system is applied to Ferrisburg, VT, located on the southern reach of Lake Champlain, with a shoreline of 14 miles, 7 of which are undeveloped. Data sources for the ratings were air photos, USGS topographical maps, Soil Conservation Service maps, and other previous studies, plus a land and water visit to each site. The evaluation system was used to develop a lakeshore land use plan, the goals of which are: (1) protection of the natural lakeshore environment, including using all wetlands as conservation areas; (2) increasing the town tax base; and (3) providing more public access to the lake through a public marina and designated swimming areas. (Iervolino-NC)
W80-04760

EVALUATION AND DESIGN OF DOWNHOLE HEAT EXCHANGERS FOR DIRECT APPLICATION,

Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8C.
W80-04764

WATER SUPPLY SERVICE FOR THE URBAN POOR: ISSUES,
Colorado Univ. at Boulder. Inst. of Behavioral Science.
G. F. White.
Water Supply and Management, Vol 2, No 5/6, p 425-454, 1978. 6 Fig, 3 Tab, 33 Ref.

Descriptors: *World Bank, *Urban Poverty Program, *Urban Poor Target Population, *Water supply, *Water delivery, *Water supply development, Water demand, Urbanization, Cities, Administration, Water distribution(Applied), Water users, Water utilization.

The author outlines the critical issues involved in choosing what type of water supply service is appropriate and practicable in applying the policy of the World Bank for the urban poor to new water supply sector reports and project appraisals. The major issues involved in those decisions are: definition of target population, definition and criteria for describing alternative types of service; estimation of health benefits in relation to standards of quality and reliability; relative emphasis upon distribution and supply improvements; the thresholds of water use requiring sewerage; pricing, repayment and subsidy policy; institutional responsibility and public education; and employment generation. The Urban Poor Target Population is the greater of the absolute or relative poor populations. The objective of the Urban Poverty Program is to increase the income and consumption of the target population by: (1) reducing the cost of, or otherwise increasing access to, basic goods and services, and (2) increasing income earning opportunities and capacity. Immediate research needs for developing solutions to issues of water supply for urban poor include: critical appraisal of conspicuous successes and failures; comparative costs of alternative services and outline for and example of a study of current water use and preferences. Long term studies would include demonstration projects and systematic review of the experience with the World Bank's regular water supply and sewerage projects and with the water and sewerage components of the Sites and Services programs. (Iervolino-NC)
W80-04765

ESTIMATING COSTS AND BENEFITS FOR NONSTRUCTURAL FLOOD CONTROL MEASURES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6F.
W80-04769

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH CAROLINA.
Army Engineer Div. South Atlantic, Atlanta, GA. January 1979. 123 p, 9 Maps, 35 Photos.

Descriptors: *Water resources development, *Flood control, *U.S. Corps of Engineers, *North Carolina, *Navigation, *Multiple-purpose projects, *River basins, *Coastal areas, Reservoirs, Project costs, Economics, Water demand, Federal government, Planning, Channel improvement, Water resources, Coastal plains, Beach erosion.

This report describes the scope and progress of water resource projects and studies by the U.S. Corps of Engineers in North Carolina. The functions of the Corps and initiation, authorization and construction of projects are described. Specific projects for the Coastal Area are presented, including 41 navigation projects, flood control in 15 areas, snagging and clearing, and beach erosion control. Studies and surveys underway and authorized are listed. There are 3 active coastal-wide projects--alteration of the Beaufort and Morehead City Railroad Bridge, aquatic plant control in estuarine waters, and the Atlantic Intracoastal Waterway. Corps projects are presented for each of eight river basins--Roanoke, Pamlico-Tar, Neuse, Cape Fear, Yadkin-Pee Dee, Santee-Catawba, Kanawha-New, and Upper Tennessee Basins. Two multipurpose projects are located in the Roanoke Basin--the John H. Kerr Dam and Reservoir with a total capacity of 2,750,349 acre-feet, installed power capacity of 204,000 kilowaters, and a drainage area of 2,750,349 sq mi above the dam, provides flood control, generation of hydroelectric power, recreation, fish and wildlife preservation and low-flow control, with cost to date of $88,362,641; and Philpott Lake, located on the Smith River, with a drainage area of 212 sq mi above the dam and total cost to date of $14,120,308. Falls Lake in the Neuse River Basin was authorized in 1965 as a flood control project. Projected completion is 1981. It will operate as part of a coordinated system for water supply, water quality and recreation. Total estimated cost is $100,000,000. Several projects have been deauthorized, one in the Yadkin-Pee Dee Basin and several in the Piedmont region. Statistical data are provided on a project-by-project basis, and maps show locations of the various projects. (Cooper-NC)
W80-04770

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04752

6D. Water Demand

ESTIMATED WATER USE IN FLORIDA, 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach, and H. G. Healy.
Geological Survey Water-Resources Investigations 79-112, 1980. 76 p, 4 Fig, 21 Tab, 28 Ref.

Descriptors: *Water utilization, *Florida, *Consumptive use, *Withdrawal, Municipal water, Irrigation water, Industrial water, Water supply, Thermal powerplants, Saline water, Freshwater.

During 1977, an average of 21,466 million gallons of water was withdrawn daily for use in Florida--an increase of 6,153 million gallons per day since 1970. The 1977 daily use was 14,812 million gallons of saline water and 6,654 million gallons of freshwater. Most of the saline water, largely surface water, was pumped from tidal estuaries. Only 107.6 million gallons per day of saline water--less than 1 percent--was obtained from wells. Thermoelectric power generation used virtually all the saline water, 14,738 million gallons per day, whereas all other industrial uses were only 73 million gallons of saline water per day. The freshwater supply was almost equally divided between ground water (53 percent) and surface water (47 percent). Of the total freshwater used, 43 percent was for irrigation--an average of 2,873 million gallons of freshwater daily on the average. The remaining daily use of freshwater was 21 percent for thermoelectric power generation, 19 percent for public supply; 14 percent for industrial use other than thermoelectric power generation; and 3 percent for domestic and rural use. Irrigation was also responsible for the greatest consumption during 1977, with 1,255 million gallons consumed daily which also includes 192 million gallons per day conveyance loss. (Kosco-USGS)
W80-04557

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
For primary bibliographic entry see Field 6E.
W80-04573

SPECIAL CONSIDERATIONS INVOLVING INDIAN RIGHTS,
Clyde and Pratt, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W80-04574

WATER USE AND SUPPLY DEVELOPMENT PLAN--EXECUTIVE SUMMARY.
South Florida Water Management District, West Palm Beach.
For primary bibliographic entry see Field 4A.
W80-04746

WATER CONSERVATION IN CALIFORNIA.
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W80-04750

CONFLICTS IN ATTAINING NATIONAL GOALS FOR BOTH WATER QUALITY AND ENERGY PRODUCTION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
S. M. Brown, F. L. Thompson, D. L. Hessel, L. Ortolano, and W. S. Hood.
Water Resources Bulletin, Vol 15, No 5, p 1236-1249, October 1979. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Conflicts, *Water quality, *Energy production, *Water pollution control, *Water supply, *Groundwater resources, Political aspects, Political constraints, Administration, Decision making, Programs, Planning, Conservation, Preservation, Environmental Policy Analysis Program, Environmental effects, Energy, Evaluation, Analysis.

The United States in the last decade has pursued two high priority goals: maintenance of high quality natural environments and achievement of energy independence. The pursuit of these two goals has resulted in numerous conflicts; this has led to the establishment of the Environmental Policy Analysis Program by the Energy Research and Development Administration (ERDA) which is now incorporated into the Department of Energy (DOE). The purpose of this program is to improve the formulation of energy development policies; it has been supported by detailed analysis conducted by the Pacific Northwest Laboratory (PNL), of specific issues related to the conflicts between energy development and environmental quality. These conflicts can be described and understood in terms of one or more of the following policy environment characteristics: resource scarcity, sense of urgency, lack of experience, administrative complexity, uncertainty about future policies and regulations, technological complexity and uncertainty about impacts. Two conflicts that were singled out because of their significance to DOE are (1) the contention by industry that certain regulations had been based on inadequate data, and (2) the energy development problems associated with water supply shortages in the arid West. Three prospective points of conflict identified are Best Available Treatment effluent limitations; the mandated regulations for controlling toxic and hazardous substances; and the new programs for controlling ground water quality. Resolving conflicts can be accomplished through an analysis of the policy environment and its characteristics which can provide a useful framework for the identification and selection of alternative actions. (Iervolino-NC)
W80-04755

WATER SUPPLY SERVICE FOR THE URBAN POOR: ISSUES,
Colorado Univ. at Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6B.
W80-04765

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH CAROLINA.
Army Engineer Div. South Atlantic, Atlanta, GA.
For primary bibliographic entry see Field 6B.
W80-04770

IMPACT OF ENERGY DEVELOPMENT ON THE LAW OF THE COLORADO RIVER,

For primary bibliographic entry see Field 6E.
W80-04775

IMPLICATIONS FOR THE FUTURE: DESIGN OF VIABLE INTERNATIONAL INSTITUTIONS,
Mexicano Inst. de Estudios Diplomaticos.
For primary bibliographic entry see Field 6E.
W80-04776

THE ENFORCEMENT OF FEDERAL RECLAMATION LAW IN THE WESTLANDS WATER DISTRICT: A BROKEN PROMISE,
For primary bibliographic entry see Field 6E.
W80-04790

REPORT TO GOVERNOR JOHN A. LOVE ON CERTAIN COLORADO WATER LAW PROBLEMS,
Holland and Hart, Denver, CO.
For primary bibliographic entry see Field 6E.
W80-04798

6E. Water Law and Institutions

A STATE OF KNOWLEDGE ON INDIAN WATER RIGHTS IN KANSAS,
Kansas Water Resources Research Inst., Manhattan.
D. C. Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170632, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, February 1980. 48 p, 5 Fig. OWRT A-093-KAN(1).

Descriptors: *Kansas, *Indian reservations, *Water rights, *Riparian rights, Prior rights, Water law, Appropriation, Adjudication procedure, Equitable apportionment, Land tenure, Reservation doctrine, Water allocation(Policy), Federal jurisdiction, Irrigation water.

Much uncertainty surrounds Indian water rights in Kansas since they may be in conflict with State given rights to water. The ever increasing shortage of water in the arid areas of Kansas is forcing the State to clarify Indian water rights to avoid continuing and future conflicts. Kansas water law subscribed to both riparian water rights and to appropriation which provides all users as much water as they need toward a beneficial use. If the water supply is not adequate then those 'first in time' are 'first in right'. This leads to problems of whether or not Indian reserves were 'first in time'. Indian land tenure in Kansas is discussed for the original tribes as well as those brought to Kansas reservations from other states. Many tribes are involved including the Kansas, Osage, Wichita, Pawnee, Commanche, Apache, Kiowa, Cheyenne, Arapaho, Cherokee, Ottawa, Kickapoo, and others. Major areas of concern in Kansas Indian water rights are: (1) interstate water allocations, (2) Indian allotees rights including non-Indian owners, and (3) reservation Indian rights. One solution would be the computation of irrigable acreage for reservations and the projection of water use involved. This computation, while not a permanent, legal judgement, could be used as a guideline in disputes. Kansas must press the Federal Government for ascertainment and adjudication of water rights so that good planning can preclude conflicts. (Seigler-IPA)
W80-04503

THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978,
Department of Commerce, Washington, DC.
R. O. Jones, W. J. Mead, and P. E. Sorenson.
Natural Resources Journal, Vol 19, No 4, p 885-908, October 1979.

Descriptors: *Continental shelf, *Resources development, *Mineral industry, *Oil industry, Legislation, Federal government, Administrative agencies, Leases, Bids, Oil pollution, Energy, Drilling.

The purpose of the 1953 Outer Continental Shelf Lands Act (Act) is to regulate the granting of mineral leases on the Outer Continental Shelf (OCS) by the federal government. The Act authorizes the Secretary of the Interior to grant mineral leases and to prescribe regulations for their administration. The 1978 Amendments respond to several areas of criticism of the 1953 Act: (1) Dissatisfaction with the primary leasing method in use - cash bonus bidding with a fixed royalty; (2) Coastal states desire to exercise more control of off-coast energy exploration; and (3) Desire for increased federal supervision of off-shore energy resources. Whereas the 1953 Act authorized only cash bonus or royalty bidding, the Amendments specify eight alternative bidding systems. Recent research shows that competition under the new bidding system has not been as intense as predicted. The 1978 legislation also mandates a significant expansion in economic planning by the Interior Secretary. These plans must be submitted to the governors of affected states for review and comment. The new legislation also provides for funds to compensate for damages arising from energy production from the OCS. (Wilson-Florida)
W80-04572

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
S. W. Reed.
Idaho Law Review, Vol 15, No 3, p 569-590, Summer 1979.

Descriptors: *Idaho, *Surface waters, *Public access, *Water quality control, Judicial decisions, Legal aspects, Public rights, Legislation, State governments, Water resources, Water rights, Water conservation.

The inevitable rush to ruin is occurring upon the natural lakes and rivers of Idaho. These lakes and rivers have been a recreational commons open for all to use. In recent years ruinous pressures have come from a rapidly increasing Idaho population and a growing use by non-residents. Conflicts over surface water rights arise in the courts and in federal, state and local governments. The judicial power over the surface waters of lakes and rivers is founded upon the public trust doctrine. The public trust doctrine has been applied to prohibit the issuance of permits to appropriate water for energy production facilities. The doctrine is not limited to prohibitions against private uses of the beds and surface waters, but may also be applied to public entities. A wide assortment of federal statutes have potential applicability to Idaho's waters, including the Rivers and Harbors Act of 1899. Idaho state control comes from the 1974 Lake Protection Act. The Act does little more than set up procedures to grant permits for various types of encroachments. County control comes from the 1975 Local Planning Act. (Wilson-Florida)
W80-04573

SPECIAL CONSIDERATIONS INVOLVING INDIAN RIGHTS,
Clyde and Pratt, Salt Lake City, UT.
E. W. Clyde.
Natural Resources Lawyer, Vol 8, No 2, p 237-252, 1975.

Descriptors: *Indian reservations, *Riparian rights, *Water allocation(Policy), Federal government, Water law, Riparian land, Diversion, Federal reservations, Agriculture, Water rights, Priorities.

Most of the land in the contiguous western states was obtained by the United States through the exercise of its sovereign powers. Since the United States originally owned the land, all settlers were trespassers. On the water rights issue, the courts ruled against riparian settlers and in favor of the first appropriator, because the settlers, owning no lands, were not in a position to assert the riparian rights doctrine. An exception to this rule of prior appropriation is the concept of reserved rights for Indians, generally known as the Winters Doctrine. Cases have arisen concerning the amount of water reserved for the Indians. The Indian water is held in trust by the federal government for the Indians. The power of the United States to reserve water could be based on its treaty powers. The Indians have a prior right to the water based on the date the Indian reservation was created. The water reserved for the Indians is not measured by past use, but by present and future needs. This determination is a judicial one for the federal courts. (Wilson-Florida)
W80-04574

THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 - THE NEWEST ENVIRONMENTAL 'SLEEPER'.
American Bar Association, Washington, DC. Committee on Environmental Controls.
The Business Lawyer, Vol 33, No 3, p 2555-2585, July 1978.

Descriptors: *Hazardous wastes, *Solid wastes, *Waste disposal, Permits, Agricultural runoff, Mine wastes, Waste dumps, Regulation, Administration, Water pollution.

These are the minutes of a program conducted by the American Bar Association's Environmental Controls Committee during which the 1976 Resource Conservation and Recovery Act (RCRA) was discussed. The discussion is focused on the RCRA's waste disposal regulating provisions. The RCRA amended the existing Solid Waste Disposal Act. Discussion is centered on the two major programs added by RCRA: (1) a hazardous waste management program; and (2) a program for phasing out solid waste open dumping. There are possible areas of overlapping between the RCRA and other federal laws. Potential problems the federal Environmental Protection Agency might face in administering the RCRA are discussed. These include: (1) defining those hazardous wastes to be regulated; (2) creating substantive standards for generators, transporters and owners or operators of facilities which treat, store, or dispose of hazardous wastes; and (3) obtaining state involvement. Potential sanctions for RCRA violations are examined. The Committee feels the RCRA has potentially widespread applicability and impact. (Daniels-Florida)
W80-04575

THE INLAND WETLANDS ACT: RECONCILING A COLLISION OF INTERESTS,
R. M. Hall, Jr.
Connecticut Bar Journal, Vol 48, No 1, p 3-29, March 1974.

Descriptors: *Connecticut, *Wetlands, *Permits, Preservation, Protection, Constitutional law, Regulation, Conservation, Legislation, Real property.

The provisions of Connecticut's Inland Wetlands Act are examined. There is a potential collision of interests between private landowners and the public at large resulting from the Act. The Act and administrative regulations attempt to resolve this potential collision. An analysis of past Connecticut wetlands cases provides insight into the reception the Act is likely to receive in court. The Act was passed as a response to concern over the need to protect and preserve inland wetland areas. Protection of wetlands is a proper legislative subject. Protection of wetlands is achieved by a permit system. Any regulation of private property raises potential conflicts of interest. The taking issue and the nuisance abatement theory are examined. The taking issue is divided into three theories: (1) the Physical Invasion Theory, which almost always requires compensation; (2) The Diminution of Value Theory, where the granting of relief is optional; and (3) the Benefit-Harm Balancing Theory. For a permit denial to be an unconstitutional taking there must be a total or nearly total destruction of the property's value, or the property must be rendered useless for any practical purpose. The Act, as a whole, is valid. (Daniels-Florida)
W80-04576

PROPERTY RIGHTS: INTERTRIBAL MINERAL RIGHTS IN THE ARKANSAS RIVERBED,
J. T. Branam.
American Indian Law Review, Vol II, No 1, p 125-135, Summer 1974.

Descriptors: *Arkansas, *Indian reservations, *Ownership of beds, *River basin development, Treaties, Boundary disputes, Patents, Legal aspects, Beds under water, Water law, Navigable waters.

The claims of three indian tribes, the Cherokees, the Choctaws and the Chickasaws, to the mineral rights in the stream bed of the Arkansas River are discussed. The U.S. Supreme Court ruled that the mineral rights in the Arkansas River belong to the Indian tribes, but did not settle the legal rights among the Indians. The general positions of the three tribes are given, including some of the supporting arguments of each position. Treaties and case law supporting each tribe's position are discussed and analyzed. Some possible courses of action to support each tribe's claim are discussed. General property principles are mentioned, but not fully discussed. No attempt is made to determine where the equitias lie. All positions are presented objectively. No final solution to the settlement of the Indian tribe's claims is offered. (Daniels-Florida)
W80-04577

BLUE LAKE: A STRUGGLE FOR INDIAN RIGHTS,
American Univ., Washington, DC.
J. J. Bodine.
American Indian Law Review, Vol I, No 1, p 23-32, Winter 1973.

Descriptors: *New Mexico, *Indian reservations, *Federal government, *Water allocation(Policy), National forests, Water rights, Treaties, History, Administrative agencies, Legislation, Water resources, Land use.

On December 15, 1970, the President of the United States (U.S.) signed into law House Bill 471, which gave trust title to 48,000 acres of land to the Taos Pueblo Indians of New Mexico. This ended a 64-year struggle by the Taos to regain their sacred Blue Lake and the high mountain land which surrounds it. This was the first time in the history of U.S.-Indian relations that a claim for land, based on the practice of aboriginal religion, successfully ended in the restoration of that land to an Indian reservation. The U.S. took over the entire region in 1848, assuming sovereignty under the Treaty of Guadalupe Hidalgo. Soon after, Anglo-American settlers began to filter into the area and settle on the traditional lands of the Taos. Blue Lake is the primary water supply source of the pueblo and consequently was of great importance to the area's agriculture. Repeatedly, the Taos made known their claims to portions of the land as non-Indian encroachment increased. Their struggle ended with House Bill 471. (Wilson-Florida)
W80-04578

GOVERNMENT REGULATION OF OIL POLLUTERS: HOW MUCH IS ENOUGH,
M. N. Mervin.
Administrative Law Review, Vol 29, No 4, p 603-609, Fall 1977.

Descriptors: *Regulation, *Oil pollution, *Administrative agencies, *Water pollution control, Legal aspects, Federal government, Oil industry, Legislation, Oil spills, Water law, Transportation, Environmental effects.

Although there has been considerable public debate over excessive government regulation, one type of overregulation has eluded the public eye - illegal, federal overregulation. An example of this type of violation is the Navigation Safety Regulations promulgated on January 31, 1977. The Secretary of Transportation declared that the new Regulations were tanker regulations developed to prevent oil spills. However, the regulations were promulgated not under the Tanker Act, but under a statute that authorizes control of vessel traffic under certain hazardous circumstances. This statute gives no general authority to prescribe navigation safety rules for all vessels everywhere. Another example of illegal overregulation is the regulation on Marine Portable Tanks. These regulations rely simultaneously on the Tanker Act and the Dangerous Cargo Act. However, the definitions of these acts are inconsistent. Moreover, these regulations have been issued without notice or opportunity to be heard, contrary to the Administrative Procedure Act. The irony in these cases of illegal regulation is that there is ample statutory authority to accomplish such regulation. (Wilson-Florida)
W80-04579

MUCH ADO ABOUT SOMETHING - DISPUTE SETTLEMENT AND THE LAW OF THE SEA CONVENTION,
National Security Council, Washington, DC. Interagency Task Force on the Law of the Sea.
R. H. Hull.
International Lawyer (A.B.A.), Vol 11, No 2, p 365-368, Spring 1977.

Descriptors: *Law of the Sea, *International commissions, *Negotiations, United Nations, Foreign countries, Treaties, International waters, Conferences, Oceans, Political aspects, International law.

For years, diplomats from many lands have been talking about the need for a new and equitable convention for the oceans. In general, the talk has focused on substantive matters. Recently, however, attention has begun to focus on an ostensible procedural question - the settlement of disputes arising out of the proposed Law of the Sea Convention. Implementation of a dispute settlement mechanism faces two primary problems. First, some states are reluctant to submit disputes to international forums for resolution. Second, many states are reluctant to have their disputes resolved by a third party. Assuming these two hurdles are overcome, the remaining question concerns the proposed provisions themselves. The dispute settlement procedure should, among other things, provide that: (1) parties may choose the means to resolve disputes; (2) methods for conciliation; (3) provisional measures to preserve the rights of the parties; (4) obligations to settle disputes by resort to arbitration or judicial settlement; and (5) disputes may only be submitted to the forum chosen by the party against which the proceedings are instituted. (Wilson-Florida)
W80-04580

THE CONCEPT OF FREE SEAS: SHAPING MODERN MARITIME POLICY WITHIN A VECTOR OF HISTORICAL INFLUENCE,
Pittsburgh Univ., PA. School of Law.
G. P. Smith, II.
International Lawyer (A.B.A.), Vol 11, No 2, p 355-363, Spring 1977.

Descriptors: *History, *Law of the Sea, *International law, Political aspects, Economics, Oceans, United Nations, Military aspects, Foreign countries, Conferences.

The concept of free seas entails conflicts and compromises. Both the politics of freedom and the concept of sovereignty have shaped the freedom of the seas and territorial waters. The historical concept of freedom of the seas, as to both ownership and use, was formulated early as a legal principle in the Roman characterization of the sea as the common property of all. In the Middle Ages, when Venice became a center of commerce, there was a strong competition among nations for use of the seas. Territorial supremacy became synonamous with sovereignty. The early politics of freedom, not sovereignty, shaped the English concept of the seas. This concept of freedom was the dominant principle by the twentieth century. Today, the United Nations Law of the Sea Conference considers anew the problems of contiguous zones and the extent of their application, exclusive economic zones, territorial seas, and coastal state jurisdiction. The continuing conflict is between expansion of sovereignty and the need for free, open seas. (Wilson-Florida)
W80-04581

ENVIRONMENTAL LAW (RESOURCE UTILIZATION, WATER POLLUTION AND AIR POLLUTION),
A. Rothstein, and D. R. Koss.
Annual Survey of American Law, Vol 1977, No 2, p 303-364, 1977.

Descriptors: *Resource development, *Industrial wastes, *Water pollution control, Legislation, Judicial decisions, Administrative agencies, Water pollution, Environmental effects, Energy, Mining, Legal aspects.

The national policy of establishing self-sufficiency in energy supplies has resulted in accelerated development of resources under federal control and increased impetus to energy research and development often at the expense of environmental quality. Some recent federal legislation bypasses the requirements of the 1969 National Environmental Policy Act (NEPA), and the courts have refused to construe NEPA more broadly than in past decisions. Part I examines three areas in which these trends have been evolving. First, legal challenges to the development of oil and natural gas resources on the outer continental shelf have revealed limits to NEPA's efficacy. Second, development of coal reserves in the northern Great Plains region has been encouraged by the 1975 Federal Coal Leasing Amendments Act and by the Supreme Court's conclusion that a regional environmental impact statement is not currently required prior to development. Third, commerce clause and federal preemption challenges have been raised against states attempting to exclude waste generated out-of-state. Part II discusses the Supreme Court's decision that the Environmental Protection Agency had authority to promulgate general regulations limiting the quantities of pollutants that may be discharged from existing industrial outlets. (Wilson-Florida)
W80-04582

COASTAL ZONE MANAGEMENT - A FEDERAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. W. Knecht.
Coastal Zone Management Journal, Vol 1, No 1, p 123-128, Fall 1973.

Descriptors: *Coasts, *Management, *Federal governments, *Governmental interrelations, Coastal engineering, Legislation, Coordination, Zoning, Local governments, State governments, Conservation.

The interrelationship between, and the rule of, local, state and federal government in coastal zone management is examined. Emphasis is on the federal government's involvement, including the changing role of the federal government. Some principles involved in this area are clarified. Important new directions being set in coastal zone management are discussed. A brief history of and the reasons for the level of each government's involvement is included. Effective coastal zone management requires coordination between governmental actions. The 1972 Coastal Zone Management Act (Act) was intended to enhance a coordinated effort. This Act is analyzed to define the new role of the federal government in coastal zone management, and to clarify the new directions being taken. Incentives to motivate state action, within and outside the Act, are briefly discussed. The Act will markedly improve management of coastal lands and resources. (Daniels-Florida)
W80-04583

CONGRESS AND COASTAL ZONE MANAGEMENT,
Senate, Washington, DC.
E. F. Hollings.
Coastal Zone Management Journal, Vol 1, No 1, p 115-118, Fall 1973.

Descriptors: *Legislation, *Coasts, *Shore protection, *Administrative agencies, Conferences, Federal government, Oceanography, Seashores, Legal aspects, Coasts, Oceans.

On October 5, 1972, the Coastal Zone Management Act (Act) cleared its final major hurdle - the Senate-House Conference - which paved the way for Congressional approval. Senate and House con-

currence on the Conference was unanimous, and the Act proceeded to the President where it was signed into law. Significant personal contributions were made during the Congressional deliberations. The National Academy of Sciences, including the Coordinating Committee on Oceanography in the early 1950's, accomplished much, and the 1959 Report of the Committee on Oceanography of the Academy was a landmark. A key issue in the Senate-House Conference was the amendment which had been made to the House Merchant Marine and Fisheries Committee bill. Members of the House Interior and Insular Affairs Committee succeeded in having the Secretary of the Interior named as the responsible federal official under the Act. The result of the Conference Committee deliberations, however, was that the federal coastal zone management program of assistance to states should be vested in the federal agency with the requisite technical expertise -- the National Oceanic and Atmospheric Administration. (Wilson-Florida)
W80-04584

SHORELAND ZONING IN MAINE,
Maine Univ. at Orono.
W. E. MacDonald.
Coastal Zone Management Journal, Vol 1, No 1, p 109-114, Fall 1973.

Descriptors: *Maine, *Shore protection, *Zoning, Legislation, State governments, Local governments, Land use, Environmental control, Shores, Water quality control, Administrative agencies.

In 1971, the Maine Legislature passed the Shoreland Zoning Law (Law). The Law called for mandatory shoreland zoning and subdivision controls. When the bill came out of committee the area to be so zoned had been modified downward to a narrow 250-foot strip of land adjacent to the state's lakes, rivers and ocean. To rezone all this area by July 1, 1973 was a formidable task for a state made up of independent minded towns and cities. Less than 20% of the 496 municipalities had previously adopted zoning. Maine's Shoreland Zoning Project provides technical assistance to state's towns, cities and plantations to enable them to prepare local plans and ordinances needed to comply with the Law. Some of the more important standards for guidance include: (1) protection of water quality; (2) building 75 foot setbacks; (3) leaving of trees; (4) guidelines for bulldozing; and (5) guidelines for wastes and chemicals. The guidelines have been well received locally because communities wanted simple guidelines to follow. (Wilson-Florida)
W80-04585

COASTAL ZONE MANAGEMENT - A NEW APPROACH IN CALIFORNIA,
P. M. Douglas.
Coastal Zone Management Journal, Vol 1, No 1, p 1-25, Fall 1973.

Descriptors: *California, *Coasts, *Resources development, *Permits, Legislation, Conservation, Regional development, Management, Zoning, Recreation, Recreation facilities.

California's new approach to coastal zone management - Proposition 20 - is examined. The new law created one state and six regional commissions to prepare a comprehensive, long-range plan for the conservation and use of California's coastal zone resources. The commissions exercise strict permit controls over new developments during the planning process. Discussed are the following: (1) the history of Proposition 20; (2) why California took this approach; and (3) Precedents for a Proposition 20 approach. The major objectives of the new law are outlined and discussed. Why the new law is limited to only coastal lands is explored. The new law's strength is found in its interim permit control system, the importance of which is discussed. The impact of Proposition 20's first eleven months as law is examined. There is a brief discussion on some logistical difficulties in getting the program started. Procedures used by the commissions, to reduce the permit workload and to further the new law's objectives are discussed. The commissions' significant problems are funding, enforcement, permit conditions, and consistency of permit decisions. Proposition 20's effect on property values is explored. (Daniels-Florida)
W80-04586

THE ROOTS OF U.S. FISHERIES POLICY,
Johns Hopkins Univ., Washington, DC. School of Advanced International Studies.
A. L. Hollick.
Ocean Development and International Law Journal, Vol 5, No 1, p 61-105, 1978.

Descriptors: *Fisheries, *Law of the Sea, *United States, Foreign countries, Fishing, Fish management, International law, United Nations, Conferences, Fish conservation, Anadromous fish.

The roots of the present United States (U.S.) fisheries policy and the 200-mile zone may be found in the period from World War II to the 1958 United Nations Conference on the Law of the Sea. Economic and technological developments during the war increased pressures for access to offshore living resources. Change in the international political system was also accelerated by the war. U.S. fisheries policy in the post war period was characterized by efforts to protect the status-quo's special interests. U.S. fishing groups and problem areas can be divided into three geographical areas - the Northwest Atlantic Ocean, The Northeast Pacific Ocean, and Latin American offshore waters. The Northwest Atlantic area has been plagued by a problem of overfishing by the United States, Canada and European nations. Relations with Latin American nations has been complicated by the implementation of the 200-mile economic zone. The overfishing of salmon in the Pacific has troubled relations between the United States and Japan. Disparate U.S. fishing interests have complicated the State Department's task of setting a single policy satisfactory to all U.S. interests. (Wilson-Florida)
W80-04587

CHANGES IN THE LAW OF THE SEA: IMPACT ON INTERNATIONAL FISHERIES ORGANIZATIONS,
Washington Univ., Seattle. Inst. for Marine Studies.
E. L. Miles.
Ocean Development and International Law Journal, Vol 4, No 4, p 409-444, 1977. 3 Tab.

Descriptors: *Law of the sea, *Fisheries, *International commissions, United Nations, Conferences, Fish management, Jurisdiction, Negotiations, Fishing, Economic impact, International law.

Impending changes in the Law of the Sea may have important implications for regional fishery commissions, for the Committee on Fisheries and the Department of Fisheries of FAO, and for FAO programs of technical assistance to fisheries. The trend in recent years has been for coastal states to extend their jurisdiction over fisheries. The Informal Single Negotiating Text of the Third United Nations Conference on the Law of the Sea recommends exclusive economic zones of up to a 200-mile limit. The combination of three major factors will effect the fishery commissions: (1) the trend toward coastal state sovereignty over living resources in the economic zone, including the determination of the allowable catch; (2) the imposition of coastal state controls over scientific research; and (3) most coastal states with increased authority over fisheries currently lack the capacity to manage these resources. In order to respond to these changes, FAO-sponsored commissions should assume greater management responsibilities and increase technical assistance and research. There is an obvious need to seek increased funding. (Wilson-Florida)
W80-04588

THE LAW OF THE SEA AND MANAGEMENT OF ANADROMOUS FISH STOCKS,
Simon Fraser Univ., Burnaby (British Columbia).
P. Copes.
Ocean Development and International Law Journal, Vol 4, No 3, p 233-259, 1977. 42 Ref.

Descriptors: *Law of the sea, *Anadromous fish, *Fish management, *Fish migration, International law, Oceans, Fisheries, Fishing, United Nations, International commissions, Jurisdiction, Treaties.

Unilateral declarations of 200-mile fishing zones by coastal states are likely to find recognition in new articles of international law. These probably will conform to the articles of the Single Negotiating Text, designed to protect and strengthen the fisheries rights of coastal states. The new rules may prove counterproductive as to the major salmon stocks that migrate beyond 200-mile limits. Effective protection of state-of-origin rights on the high seas will be difficult. Distant water fishing fleets will be tempted to intensify their efforts on high seas stocks. Salmon interception by neighboring states will also remain a problem. Several protective strategies and accomodations may be pursued by states-of-origin. One is to establish an international authority charged with regulating high seas fisheries. Another approach is to buy off individual states which have the inclination to fish for salmon on the high seas. Interception problems might be solved by joint management of stocking and fishing. (Wilson-Florida)
W80-04589

FROM CARACAS TO GENEVA TO NEW YORK: THE INTERNATIONAL SEABED AUTHORITY AS A CREATOR OF GRANTS,
Purdue Univ., Lafayette, IN. Dept. of Political Science.
M. E. Galey.
Ocean Development and International Law Journal, Vol 4, No 2, p 171-193, 1977. 1 Tab.

Descriptors: *Law of the sea, *Mining, *International commissions, International law, United Nations, International waters, Jurisdiction, Oceans, Treaties, Conferences, Mineral industry.

In 1970, the United Nations General Assembly adopted the Declaration of Principles on the Peaceful Uses of the Seas Beyond the Limits of National Jurisdiction. The Group of 77 has proposed an International Seabed Authority (ISA) empowered to control directly all activities in the international seabed area. The United States supported an ISA empowered to provide the opportunity for mining interests to explore and exploit resources in the area relatively free of production and other types of controls. A seldom discussed economic approach, the grants approach, may help explain the conflict between the U.S. and the Group of 77. Agreement on the ISA might occur when the different assumptions as to who is grantor and who the grantee coincide. At that point, the mix of grants and exchanges would be acceptable to both parties. If the ISA were established, it would create grants to the international community. However, the critical issue in explaining the conflict is to determine the identity of the grantor and grantee. (Wilson-Florida)
W80-04590

WATER BASED RECREATIONAL DEVELOPMENTS IN MICHIGAN - PROBLEMS OF DEVELOPERS,
Wayne State Univ., Detroit, MI.
R. W. Bartke, and S. H. Patton.
Wayne Law Review, Vol 25, No 4, p 1005-1063, July 1979.

Descriptors: *Michigan, *Lake shores, *Public access, Legislation, Water allocation(Policy), Riparian land, Recreation demand, Riparian rights, Development, Water law, Conservation.

More people than ever before desire access to waterbodies for recreational purposes. This demand intensifies pressures on the inland water resources of Michigan. High cost and decreasing availability of suitable property often preclude the development of single unit, horizontal subdivisions on waterfront lots. The system of water rights which predominates in Michigan is riparianism. Riparian rights arise by virtue of title to the bank or shore and cannot be conveyed separately. The use of private waters is limited to riparian owners. Limitations on lake shore developments and water

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use include: (1) federal, state and local legislation; (2) financing; and (3) common law limitations, such as the reasonable use doctrine and narrow definitions of riparian owners. Developers have used various tools to extend lake access and use. Traditional lake shore developments include: (1) developments abutting the water; and (2) developments with backlots, such as tenancies in common, condominiums, and homeowners' associations. Developers are now providing consumers with a more complete package by the use of condominuims, cooperatives, and planned unit developments. At the same time, developers must be alert to judicial and legislative action affecting the use and improvement of waterfront property. (Wilson-Florida)
W80-04591

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
H.R. Rep No 1156, 95th Cong, 2nd Sess (1978), reprinted in 11 U.S. Code Cong and Ad News 4991 (1978).

Descriptors: *Research and development, *Water supply development, *Water resources development, Water resources research act, Impaired water use, Research facilities, Saline water, Administrative agencies, Grants, Programs, Information exchange.

The purpose of the 1978 Water Research and Development Act (Act) is to extend and modernize the organic charter controlling the water resources research and saline water conversion programs of the Department of the Interior. This Act substantially reenacts the Water Resources Research Act of 1964 and the Saline Water Conversion Act of 1971. The policy objectives are twofold. First, that general water resources research programs and saline conversion programs have separate sources in law. Second, that all authorizations for funding will be on a two-year cycle. There are four titles: Title I - Water Resources Research and Development; Title II - Water Research and Development for Saline and other Impaired Waters; Title III - Technology Transfer and Information Dissemination; and Title IV - General Provisions. The Committee on Interior and Insular Affairs adopted one amendment which, among other changes, converted all appropriations authorizations to specific amounts. The inflationary impact of the Act will be minimal and will be offset by its affirmative benefits. The Committee on Interior and Insular Affairs will maintain continuing oversight of the programs authorized. The Assistant Secretary of the Interior filed on executive communication with the Speaker of the House, explaining the Act and recommending its passage. (Wilson-Florida)
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
Act of Oct 17, 1978, Pub L. No 95-467, 92 Stat 1305, 11 U.S. Code Cong and Ad News (1978) (codified at 42 U.S.C. 7801 et seq).

Descriptors: *Research and development, *Water resources development, *Water supply development, Impaired water use, Grants, Saline water, Administrative agencies, Research facilities, Information exchange, Programs, Water resources research act.

The purposes of the 1978 Water Research and Development Act (Act) are to provide a water supply to meet the nation's needs, to preserve water resources, and to promote research and conservation. In Title I - Water Resources Research and Development - the Secretary of the Interior is authorized to assist in carrying on the work of a qualified water resources research and technology institute in each state. These institutes shall submit annual reports to the Secretary. The Secretary is charged with the proper administration of this title, and may prescribe such rules and policies as are necessary to carry it out. In Title II - Saline and other Impaired Waters - the Secretary is authorized to conduct and promote research to develop effective methods for conversion of impaired water into water for beneficial uses. The Secretary may conduct cooperative agreements with non-federal utilities and governmental entities. In Title III - Technology Transfer and Information Dissemination - the Secretary is authorized to transfer research and development results to other organizations for further development. Further, the Secretary is authorized to maintain a national center for the dissemination of water resources research information. To carry out the program funds are appropriated on a cost-sharing basis. (Wilson-Florida)
W80-04593

WATER RESOURCES DEVELOPMENT ACT OF 1978.
Hearings Subcomm on Water Resources, Comm on Public Works and Transportation, U.S. House, June 20,21,22 and 27, 1978, Serial No 95-60, p 518.

Descriptors: *Flood control, *Navigable waters, *Water resources development, Floods, Navigation, Navigable rivers, Dredging, Economic impact, Engineering, Engineers estimates.

H.R. 13059 was introduced in the House of Representatives on June 8, 1978 as a bill authorizing the 'construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and for other purposes.' The bill then lists thirteen projects for which improvement is authorized. The bill also makes several amendments to the 1976 Water Resources Development Act. The Secretary of the Army, acting through the Chief of Engineers, is given authority to undertake many different activities in a number of geographical areas: (1) the control of river and harbor ice; (2) the construction of bank protection works; (3) the implementation of flood control measures in general; and (4) the performance of intermittent dredging to remove shoals. The bill also discusses costs of the various projects and the percentage that will be paid by the federal government. The report of the daily hearings on the bill is extremely extensive. The Act is to be cited as the 'Water Resource Development Act of 1978.' (Tabano-Florida)
W80-04594

KANSAS WATER RIGHTS: MORE RECENT DEVELOPMENTS,
Kansas Supreme Court, Topeka. Disciplinary Administrator.
A. Windscheffel.
The Journal of the Kansas Bar Association, Vol 47, No 3, p 217-223, Fall 1978.

Descriptors: *Consumptive use, *Kansas, *Water rights, Riparian rights, Legal aspects, Ground water, Indian reservations, Damages, Remedies, Eminent domain.

Summarized are recent court decisions and legislation affecting surface and groundwater rights in Kansas. Emerging from the 1978 session is Senate Bill 523. This Act requires all persons claiming vested rights for the beneficial use of water, other than domestic uses, which have not been determined pursuant to a previously repealed statute shall file a verfied claim with the chief engineer by July 1, 1980. With few exceptions, vested rights to water in Kansas within the scope of this Act will be resolved after the above date. A preliminary analysis of several cases involving damages sought for unlawful water collection and diversion presents an apparent conflict. The court appears confused over when damage has accrued, and when the statute of limitations begins to run in such actions. Injunctive relief in cases of water pollution is also analyzed. There is an apparent need to harmonize statutory law with present conceptions, needs, and changing conditions in Kansas. (Schwerer-Florida)
W80-04595

INTERGOVERNMENTAL ASPECTS OF WATER TRANSFER IN IDENTIFICATION AND ASSESSMENT OF FEDERAL AND INTERSTATE ISSUES AND CONSTRAINTS,
Oklahoma State Univ., Stillwater. Dept. of Political Science.
J. W. Westphal, and J. J. Lawler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173578, Price codes: A03 in paper copy, A01 in microfiche.
Oklahoma Water Resources Research Institute. Oklahoma State University Technical Completion Report, April 1980. p 30, 3 Fig, 4 Tab. OWRT A-084-OKLA(1), 14-34-0001-9038.

Descriptors: *Oklahoma, Interstate, *Interstate commissions, *Interstate compacts, *Interstate rivers, River basin commissions, River basins, Texas, Kansas, Arkansas, Federal Government, Water resources development, Water supply development, River basin development, *Water transfer.

Intergovernmental aspects of water transfer from eastern to central and western Oklahoma were analyzed vis-a-vis three neighboring states (Texas, Arkansas, and Kansas). The three major objectives of the study were: to identify new proposals and developments since release of Phase I of the Oklahoma Comprehensive Water Plan; to identify major inter-state and national-state issues raised by the plan; and to assess the implications of these intergovernmental factors for implementation of the Plan. New proposals and developments include elaboration of the northern phase of the conveyance system, and the determination that conveyance of water for irrigation uses cannot be justified by economic criteria for federal water projects. Inter-state aspects include legal ramifications of four interstate compacts, and problems of coordinating planning efforts with neighboring states. Federal-state relations were considered in the context of court decisions in Arizona v. California and California v. United States; the U.S. Water Resources Council's major planning objectives; the High Plains Project of the Economic Development Administration; and the requirements of the National Environmental Policy Act of 1969. The impossibility of planning instate water development apart from a regional and inter-governmental context is stressed.
W80-04602

JOJOBA: AN ALTERNATIVE TO THE CONFLICT BETWEEN AGRICULTURAL AND MUNICIPAL GROUND WATER REQUIREMENTS IN THE TUCSON AREA, ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 3F.
W80-04667

GROUND WATER VS. HAZARDOUS WASTES,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W80-04675

STATE AGENCY EFFORTS IN WATER CONSERVATION.
California State Dept. of Water Resources, Sacramento. Div. of Planning.
For primary bibliographic entry see Field 3D.
W80-04747

A PILOT WATER CONSERVATION PROGRAM.
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W80-04749

INTERCEPTOR SEWERS AND URBAN SPRAWL,
Urban Systems Research and Engineering, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5D.
W80-04751

ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES,
Resources for the Future, Inc., Washington, DC.
F. R. Anderson, A. V. Kneese, P. D. Reed, R. B.

Stevenson, and S. Taylor.
Johns Hopkins University Press, Baltimore. 1977. 196 p.

Descriptors: *Pollution, *Pollution control, *Pollution taxes(Charges), *Pollution abatement, *Political aspects, *Economic justification, *Resources, Water pollution control, Pricing, Social aspects, Policy, Management, Economics, Equity, Costs, Cost-benefit analysis, Water pollution, Legal aspects, Natural resources.

The use of money charges to discourage environmental harm is addressed and the economic, technical, legal and political problems which need to be resolved in order to implement charge plans is discussed. Because common property resources such as air and water have not been quantitatively valued, they are treated as 'free goods' and are subject to extreme abuse by economic forces. In implementing charges, all of the complex social costs incurred by an activity should be considered. Charges and direct regulation are compared; charges are seen to be more cost effective than direct regulatory approaches. An economic rationale for charges is presented, explaining how the market system should work to allocate resources, why it does not work for environmental resources, and how and why charges would remedy the problem. Results are presented of surveys of environmental quality management schemes which employ the charges concept. Water pollution and water quality control charges include effluent charges, charges to finance collective control measures, and charges in conjunction with effluent standards. An effluent charge system in use in Czechoslovakia for 10 years is described. Monitoring systems for water and air pollution pose problems. Several basic approaches for measuring discharges are presented. Means of implementing charges through legislation and legal constraints are discussed, as well as political and institutional constraints. Any charge plan must be well designed, and must be politically feasible. Charges have sufficient potential advantage over alternatives to justify implementation. Pollution charges have advantages of administrative and economic efficiency as well as equity and should be pursued in the political arena. (Arnold-NC)
W80-04752

RESERVED WATER RIGHTS AND OUR NATIONAL FORESTS,
H. T. Brooks.
Natural Resources Journal, Vol 19, No 2, p 433-443, April 1979.

Descriptors: *Winters Doctrine, *Water law, *National forests, *Gila National Forest(NM), *Court decisions, Reserved lands, New Mexico, Timber, Water rights, Legal aspects, Federal-state water rights conflicts, Legal review, Judicial decisions.

The case of United States vs New Mexico (1978) is the most recent modification by the Supreme Court of the 'Winters Doctrine,' which provides that federally reserved lands have sufficient accompanying water rights to accomplish the purpose for which the lands were reserved. This case clarified the doctrine by holding that the Gila National Forest in southwest New Mexico has reserved water rights only for the primary purposes for which it was established, but not for any secondary purposes. The primary purposes recognized by the Court for National forests are furnishing a continuous supply of timber and securing favorable water flows. The history of the Winters Doctrine dates back to the 1899 case U.S. vs Rio Grande Dam and Irrigation Company but the first real articulation of the doctrine came in its namesake, Winters vs. U.S. in 1908. The doctrine was extended through numerous subsequent cases. The effects of the most recent case have been to reduce the quantity of reserved rights which may be claimed by the federal government for national forests, and to establish that water for other primary purposes must be obtained by the U.S. from the state or through the power of eminent domain. Also, all future permittees of the national forests will be required to adjudicate their rights according to state law. Finally, this decision may be indicative of a new attitude toward the Winters Doctrine as it applies to national forests. (Iervolino-NC)
W80-04754

CONFLICTS IN ATTAINING NATIONAL GOALS FOR BOTH WATER QUALITY AND ENERGY PRODUCTION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
For primary bibliographic entry see Field 6D.
W80-04755

A SYSTEMS RESOURCES APPROACH TO CITIZEN PARTICIPATION: THE CASE OF THE CORPS OF ENGINEERS,
North Carolina State Univ. at Raleigh. Dept. of Political Science.
T. D. Edgmon.
Water Resources Bulletin, Vol 15, No 5, p 1341-1352, October 1979. 29 Ref.

Descriptors: *Citizen participation, *Water resources, *Planning, *Corps of Engineers Urban Studies, *Decision making, *Administrative decisions, Administration, Institutions, Management, Project planning, Political aspects, Atlanta(GA), Albuquerque(NM), Pittsburgh-Wheeling(PA).

Citizen participation is identified as a process for decentralizing administrative decisions, making agencies 'responsive' to grass roots or local needs and values. But while citizen participation has the potential to facilitate an alteration in administrative decisions, it is not sufficient in itself to affect this change. Alterations in administrative decisions require the alteration of agency goals. The goal process is the product of coalition formation and bargaining. Therefore, citizen participation is effective only if it allows for the participation of organized groups with linkages to policy areas where other resources necessary for the maintenance of the organization are allocated. In the Corps of Engineers Urban Studies Program guidelines defined a citizen participation process going beyond the traditional public hearings format; procedures were to be established for developing public interaction in the planning process. This planning process was observed in three Corps districts: Atlanta, Pittsburgh-Wheeling, and Albuquerque. In Atlanta, substantive citizen-initiated issues find a way into the planning process, while in the other two study areas they do not. These outcomes can be attributed to Corps organization and the regional institutional environment of each of the districts. The study of these three districts illustrates the necessity of the citizen participation approach which assumes that in order to be able to exercise influence in goal setting, a group must be able to influence the flow of resources into the organization. (Iervolino-NC)
W80-04756

COASTAL STATES HAVE CONTROL OF COASTAL RESOURCES,
C. G. Lackmann.
Natural Resources Journal, Vol 19, No 2, p 393-397, April 1979.

Descriptors: *Coastal resources, *Water rights, *Channel Islands National Monument(CA), *Beds, *Legal aspects, *Court decisions, California, Submerged Lands Act of 1953, Paramount rights, Coasts, Islands, Continental Shelf, Legislation, Judicial decisions, Water.

A recent decision in the U.S. Supreme Court, United States vs. California (1978), held that the economically valuable waters and submerged lands within one mile of the Channel Islands National Monument belong to California, not the federal government. This holding will have a major impact on the coastal industry around the United States. The Channel Islands National Monument consists of most of the Santa Barbara and Anacapa Islands located west of Los Angeles and lying between Santa Cruz Island and Santa Catalina. The Court's reasoning was based on the Submerged Lands Act of 1953 which gives the states ownership and control of all coastal lands and waters claimed by the federal government under the doctrine of paramount rights. The particular lands and waters in question possess substantial economic value. Actions by California to attempt to lease these lands for oil, gas and mineral exploration led to the case. The instant case involves commercial harvesting of giant kelp, Macrocystis. The decision in this case indicates a policy established by Congress and enforced by the Court of placing highly valued coastal resources under control of the states. (Iervolino-NC)
W80-04757

COORDINATING LAND AND WATER USE PLANNING FOR SOUND RESOURCE MANAGEMENT,
Florida Univ., Gainesville.
F. E. Maloney.
Water Supply and Management, Vol 2, No 3, p 253-263, 1978.

Descriptors: *Land use, *Land management, *Water pollution control, *Water, *Federal Water Pollution Control Act of 1972, *Planning, *Water resources planning, Pollutants, Effluents, Sewage treatment facilities, Florida, Water management(Administrative), Water quality, Water use, Water resources, Legislation.

Land use planning and management is the only cost-effective means for controlling pollutants and should be coordinated for regulatory efficiency. The Federal Water Pollution Control Act (FWPCA) Amendments of 1972 established three water pollution control programs: (1) National Pollutant Discharge Elimination System (NPDES); (2) a system of grants for funding waste water treatment facilities; and (3) a complex system of three interrelated planning programs. NPDES is designed to impose effluent standards and limitations by requiring permits for the discharge of all pollutants from point sources into navigable waters. The second program of grants is an attempt to aid municipalities in meeting the standards set for sewage treatment. The three interrelated planning programs include funding of municipal treatment facilities under Section 201 of the Act; basin planning under Section 303(e); and Section 208 areawide waste treatment plans. In Florida land and water use planning depend on essentially separate regulatory systems. Land development is regulated by a combination of the Environmental Land and Water Management Act and local zoning regulations. Water is managed by the regional water management districts established under the 1972 Florida Water Resources Act. These two systems are intended to complement one another but there are serious inefficiencies attributable to the lack of statutory consolidation. (Iervolino-NC)
W80-04761

REFLECTIONS ON GROUND WATER MANAGEMENT,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 4B.
W80-04762

THE WATER GRID CONCEPT,
California State Dept. of Water Resources, Sacramento.
R. R. Reynolds.
Water Supply and Management, Vol 2, No 2, p 147-157, 1978.

Descriptors: *Water grid, *Water utilization, *Water resources development, *Water distribution, *Water management, Water supply, Water demand, Water supply development, Water delivery, Planning, Administration.

The phases in the history of water development are: (1) development of surface-water supplies; (2) development of groundwater supplies; (3) coordination of use of surface- and groundwater supplies; (4) water conveyance facilities; and (5) management of use of water. A water grid should have the following characteristics: (1) be a conveyance system; (2) have alternative sources and routes; (3) have interconnecting links; (4) have sufficient con-

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veyance capacity to meet peak demands as they occur with some excess capacity; (5) be connected to, and convey water from, all sources including those under the various phases of the hydrologic cycle and those where water is made available by technological processes such as desalination; (6) operation of the facilities of the grid system could be coordinated and there could be an integrated management. The water grid would link the water sources to the areas of water demand. The most significant aspects are large interbasin and interregional aqueducts, and central coordination and management. Possible arrangements to give operational flexibility include exchange of water and capacity in reservoirs; exchange of water and capacity in aqueducts; power exchange; power and water banking; exchange of use of facilities; on-peak and off-peak operation of generation and pumping facilities; operation to maximize power production and operation to maximize water yield; controlled volume concept of aqueduct-operation; long-range forecasts; computer studies; and centralized operation control. (Iervolino-NC)
W80-04768

IMPACT OF ENERGY DEVELOPMENT ON THE LAW OF THE COLORADO RIVER,
G. D. Weatherford, and G. C. Jacoby.
Natural Resources Journal, Vol 15, No 1, p 171-213, January 1975.

Descriptors: *Colorado River, *Water allocation(Policy), *Energy, *Water demand, Reclamation, Agriculture, Water rights, Water law, Resources development, Water quality, Environmental effects, Water supply.

Profound changes are now occurring in the Colorado River Basin. New societal demands for water are on a collision course with vested legal rights and past commitments. The exploitation of fossil fuels in the area poses great problems for the traditional paramount concerns of reclamation and agriculture. The 'law of the river' is actually a composite of many statutes, compacts, court decisions, contracts, regulations and administrative rulings. Generally speaking, the flow of the Colorado River is divided among users on the basis of beneficial consumptive use. The allocation system operates at four levels: international, interregional, interstate, and intrastate. Legal problems on the river are partially the function of changes in the ratio of water supply to water demand, with a rising water demand curve. The scale of dislocation and change expected over the coming decades can be handled by the legal system through water conservation and the acquisition or condemnation of water rights. Vested rights will be subject to increased regulation in order to effect needed changes. (Wilson-Florida)
W80-04775

IMPLICATIONS FOR THE FUTURE: DESIGN OF VIABLE INTERNATIONAL INSTITUTIONS,
Mexicano Inst. de Estudios Diplomaticos.
L. C. Sepulveda.
Natural Resources Journal, Vol 15, No 1, p 215-221, January 1975.

Descriptors: *International Boundary, *Water Commission, *Colorado River, *Boundary disputes, Treaties, Mexico, United States, Water rights, International commissions, Border iffigation, International Law, Water demand.

Upon approval by both governments, Minute 242 of the International Boundary and Water Commission of August 30, 1973, became an executive agreement which represents a satisfactory arrangement concerning the use of the waters of the Colorado River. This instrument reveals the possibility of reaching agreement in other conflicting areas which may arise between Mexico and the United States because of the waters of that river. The growing scarcity of waters throughout the course of the Colorado River, the constant increase of use of the upstream waters, the continuous absence of rains, and the overestimation of flow all indicate that a problem could arise between the two countries. The underground waters along the border may also be a problem in the future. Thus, adequate international institutions should be provided for the administration of discrepancies and for the avoidance of conflict. There exist between the United States and Mexico sufficient bilateral and multilateral instruments for the amicable adjustment of controversies, especially through arbitial means. Fundamental to a solution to disputes should be the International Boundary and Waters Commission. (Wilson-Florida)
W80-04776

THE MANAGEMENT OF INTERNATIONAL BOUNDARY WATERS OF CANADA AND THE UNITED STATES: A COMPARATIVE STUDY,
Cornell Univ., Ithaca, NY. Water Resources and Marine Sciences Center.
L. B. Dworsky.
Natural Resources Journal, Vol 15, No 1, p 223-227, January 1975.

Descriptors: *Boundary disputes, *International Joint Commission, *Great Lakes, Treaties, United States, Boundaries(Surfaces), Canada, International Law, Foreign countries, Navigable waters.

Canada and the United States share a continuous boundary 3,600 miles in length. Since the 1909 Boundary Water Treaty (Treaty), the International Joint Commission has been actively engaged in helping to resolve water related disputes. Some of these cases were readily amenable to solution; others, like the problems in the Columbia River Basin, were more complex; and many of the Great Lakes' problems have not yet been solved. Since 1909, no substantial review has been made of the International Joint Commission, nor has substantial consideration been given to improving the management of the Great Lakes. The Treaty gives the Commission responsibility in two general areas. The first area is the approval or disapproval of all proposals for use, obstruction, or diversion of boundary waters. The second responsibility is to investigate and make recommendations on specific problems referred to it by either government. It would appear to be very useful to consider the formation of another commission for the Mexican-United States boundary waters. (Wilson-Florida)
W80-04777

GUARDING THE TREASURES OF THE DEEP: THE DEEP SEABED HARD MINERAL RESOURCES ACT,
D. W. Proudfoot.
Harvard Journal on Legislation, Vol 10, No 4, p 596-620, June 1973.

Descriptors: *Law of the Sea, *Resources development, *Mineral industry, Regime, Conservation, Mining, International law, Treaties, Exploitation, Beds under water, International waters.

As a response to the need for clarification and development of maritime mineral resources law, the Oceans Policy Statement was promulgated by the Nixon Administration. Part of this statement calls for an interim regime which would allow continued seabed exploration and exploitation beyond the present limits of national jurisdiction, pending establishment of an international regime. In response to this oceans policy, the Deep Seabed Hard Mineral Resources Act (DSHMRA) was introduced, but never voted on. The problem of establishing an interim regime for hard minerals is addressed. Whether the DSHMRA is a proper response to this problem is assessed. International law has not kept abreast of the seabed's mineral potential. The United States is committed to developing deep seabed resources pursuant to an international regime. The mining industry's position is one of immediate mineral development. The Mineral Resources Act (MRA) is their proposal which would establish a mandatory system of first-come-first-served licensing for hard mineral mining. The MRA accomplishes none of the objectives that a proper response to the problem should, but, if adopted in modified form, it would be a useful instrument of national policy. (Daniels-Florida)
W80-04778

COASTAL CONTROLS IN CALIFORNIA: WAVE OF THE FUTURE,
R. C. Breeden.
Harvard Journal on Legislation, Vol 11, No 3, p 463-508, 1974.

Descriptors: *California, *Coasts, *Shore protection, Legislation, Permits, Regulations, Programs, Project planning, Management, Protection, Environmental control.

In response to a perceived manmade threat to the natural characteristics of the California coastal zone, a citizen-sponsored coastal initiative, the 1972 California Coastal Zone Conservation Act (Act) was enacted. The Act has three basic objectives: (1) to establish a policy of coastal protection and environmental concern; (2) to create interim controls on development through a permit system; and (3) study the needs of the coastal zone and recommend a plan for long-term management of the coast within 4 years. The Act's provisions are analyzed; the results of its operation during the first 16 months are examined; and its legal implications are considered. Briefly examined are the unique power, duties, membership requirements and responsabilities of the enforcement commissions. The permit control system is very important in the short-run. Early problems have been encountered, most significantly the enormous backlog of permit applications. Instances of permit denials and conditional grants are examined. The planning process in operation is examined. While some success has been achieved, long-run coastal control will fail, if the immediate pressures of permit regulation divert the commissioners from designing the best possible plan. (Daniels-Florida)
W80-04779

INTERNATIONAL LAW AND MARITIME JURISDICTION IN RELATION TO SEA RESOURCES: THE CASE OF FISHING IN PERU,
R. J. Payne.
Howard Law Journal, Vol 18, No 2, p 361-384, 1974.

Descriptors: *Fisheries, *Jurisdiction, *Law of the sea, Resources, Resource development, International law, Technology, Economic justification, Fishing, Exploitation.

Advanced technical knowledge enables man to explore and develop what once was beyond his imagination. These advances affect law and relations, and call for revisions and adjustments in international law. With advanced technology, a new emphasis is placed on the ocean as a food source. This challenges traditional territorial water limitations, such as the three-mile limit, and cooperation in exploiting marine resources, especially fisheries. Nations lacking this technology, especially Peru, are unable to compete with technologically advanced nations for fisheries resources, which are essential to their development. The relation of fisheries to territorial waters and maritime jurisdiction is examined. Fishing has always played a major role in the economic welfare of many maritime states, especially Peru. Peru's claim to a 200-mile jurisdictional zone can be seen as a necessary action to prevent uncontrolled exploitation of fish by technologically advanced nations. Economic conditions within countries determines the nature and content of international law to a large extent. International law must suit present conditions. The three-mile limit grew out of circumstances no longer prevailing. (Daniels-Florida)
W80-04780

ENFORCING THE FEDERAL WATER RESOURCE SERVITUDE ON SUBMERGED AND RIPARIAN LANDS,
B. H. Johnson.
Duke Law Journal, Vol 1977, No 3, p 347-388, May 1977.

Descriptors: *Federal Water Pollution Control Act, *Rivers and harbors act, *Riparian land, *Easements, Regulation, Water resources, Administrative agencies, Public access, Legislation, Regulation, Navigable waters, Public rights.

Congress has customarily substantiated public water resource rights by enacting federal restrictions on private activities in or around waters and adjacent wetlands. Enforcement of federal controls is difficult and complex because of a wide variety of geographical settings, policy considerations, equities and public interests. Past enforcement efforts were on an ad hoc basis. Recent developments show a move toward programmatic approaches to enforcement. Current developments in the federal enforcement effort are examined. Congressional restrictions imposed on owners of submerged and riparian lands by the 1899 Rivers and Harbors Appropriation Act and the 1972 Federal Water Pollution Control Act Amendments are generally discussed. These acts effectively burden submerged and riparian lands with a federal water resource servitude. Administrative enforcement efforts, including cease-and-desist orders, self-help remedies, and judicial enforcement efforts, allowing for civil and criminal penalties and injunctions, are explored. While a broad range of remedial measures are at the federal government's disposal, the complexity of the enforcement task requires additional remedies. Enforcement should begin with the administrative process, and agencies should be provided with necessary remedial measures. (Daniels-Florida)
W80-04781

MUSING ON THE BOTTOM: ECONOMIC AND LEGAL IMPLICATIONS OF THE UNITED STATES' PROPOSED DRAFT UNITED NATIONS CONVENTION ON THE INTERNATIONAL SEABED,
Lewis and Clark Coll., Portland, OR.
E. J. Brunet.
University of Illinois Law Forum, Vol 1974, No 2, p 251-284, 1974.

Descriptors: *Beds under water, *Law of the sea, *Resources development, Legal aspects, Economic impact, International waters, Oceans, Resources, Mineral industry, United Nations, International commissions.

No legal norms governing use of the ocean's seabed exist. There is an immediate need for consideration of institutional arrangements to control marine resource exploitation. On May 23, 1970, President Nixon announced a revolutionary ocean seabed policy for the United States (U.S.) that was subsequently submitted to the United Nations (U.N.). This proposal would provide the legal structure governing almost three-quarters of the earth's area, with corresponding monumental political and economic significance. The core of the U.S. proposed convention is its novel ownership provision. The International Seabed Area would be open to use by all states, considered the common heritage of mankind. The proposal creates an international political entity and U.N. affiliate, the International Seabed Authority, to govern ocean seabeds. An exploitation license, granted by the Seabed Authority, would be a prerequisite to seabed mining. An analysis of the U.S. proposal identifies certain inherent inefficiencies. (Wilson-Florida)
W80-04782

FEDERAL ENVIRONMENTAL LITIGATION IN 1976: THE FEDERAL WATER POLLUTION CONTROL ACT,
K. M. Hunciker, and V. Pagano, Jr.
Harvard Environmental Law Review, Vol 1, p 59-101, 1976.

Descriptors: *Waste water treatment, *Federal water pollution control act, *Water quality standards, Judicial decisions, Legal aspects, Federal government, Effluents, Legislation, Administrative agencies, Industrial wastes, Environmental control.

The 1972 Federal Water Pollution Control Act Amendments (Act) are a crucial element in the nation's battle against pollution. The most important litigation under the 1972 Amendments resulted from industry challenges to the federal Environmental Protection Agency's (EPA) promulgation of effluent limitation regulations for industrial wastewater discharges. The affected industries challenged EPA's authority under the Act on several grounds: (1) the issuance of binding effluent limitations; (2) the procedures under which these limitations are to be imposed; and (3) the merits of the specific pollutant limits themselves. A major requirement of the Act is that uniform effluent limitations be achieved for all industrial point sources by July 1, 1977, and July 1, 1983, based on the technology required. Delays in issuing standards, granting permits, and in judicial review of regulations have ensured that the 1977 deadline will not be met. Section 509(b)(1) provides for judicial review of the promulgated effluent limitations. Court challenges have become a major time barrier to attaining the 1977 and 1983 deadlines. (Wilson-Florida)
W80-04783

THE COASTAL ZONE MANAGEMENT ACT AMENDMENTS OF 1976,
A. C. Yahner.
Harvard Environmental Law Review, Vol 1, p 259-288, 1976.

Descriptors: *Coasts, *Shore protection, *Energy, Programs, Legislation, Federal government, Research and development, Development, State governments, Public access, Planning.

In enacting the 1976 Coastal Zone Management Act Amendments (Amendments) Congress sought to expand the Act to compensate for the effects of energy facilities on coastal areas. The Amendments establish a 1.2 billion-dollar program to aid the states in planning the location of specific facilities, in financing public projects such as schools and roads necessitated by these facilities, and in ameliorating environmental losses. The Amendments also expand the original planning program by requiring three new planning elements dealing with beach access, coastal erosion and energy facilities siting. In addition, three new funding programs are established to provide money for interstate coordinated activities, for research and technical assistance, and for acquiring access to shorefront areas. The Amendments establish a Coastal Energy Impact Fund to provide grants, loans, and guarantees for states to plan for and mitigate the impacts of new coastal energy activities. The Amendments also raise a number of questions concerning their effect on the original Act. (Wilson-Florida)
W80-04784

IMAGES AND MODELS IN THE WORLD COURT: THE INDIVIDUAL OPINIONS IN THE NORTH SEA CONTINENTAL SHELF CASES,
Sheffield Univ. (England).
J. G. Merrills.
The Modern Law Review, Vol 41, No 6, p 638-659, November 1978.

Descriptors: *Continental Shelf, *International waters, *Law of the sea, International commissions, International law, Governments, Governmental interrelations, Water law, Law enforcement, Judicial decisions.

The individual opinions in the North Sea Continental Shelf cases are examined for evidence of so-called 'images' and 'models' of international law. The cases arose out of a dispute between Denmark and the Netherlands on one side and the Federal Republic of Germany on the other, relating to the delimitation of their respective areas of the North Sea Continental Shelf. These cases decided there was no single method of delimitation obligatory in all circumstances. Delimitation was to be effected by equitable agreement. The individual opinions are discussed in considerable detail. The significance of images and models is analyzed. Images are viewed as 'conceptions of concrete situations lurking behind proposals for solutions to general problems'. Models are seen as 'the mental constructs of the world we employ to organize our thinking about international law.' Applied to the individual opinions, the different models and images are viewed as the reason for the gulf dividing contemporary theories of international law. (Tabano-Florida)
W80-04785

CURRENT ENVIRONMENTAL LAW: TAKING OR REGULATION,
R. L. Bisso.
Loyola Law Review, Vol 24, No 4, p 649-677, Fall 1978.

Descriptors: *Land use, *Coastal plains, *Shore protection, Economics, Environmental effects, Ecology, Compensation, Constitutional law, Environment, Eminent domain, Environmental control.

A conflict exists today between the pressures of economic land exploitation and the pressure to maintain environmental quality through land use legislation. The taking issue is discussed in light of recent coastal and shoreline protection regulation. The current state of the taking issue is reviewed, beginning with Pennsylvania Coal v. Mahon, and following through to the recent Penn Central Transportation Company v. City of New York. The constitutional elements of the taking issue are discussed, emphasizing the distinction between eminent domain and the police power. The regulatory trend has shifted now from an emphasis on economic values to ecological, social and aesthetic ones, and this switch is reviewed through an analysis of the 1972 Federal Coastal Zone Management Act, the Marinette County, Wisconsin Shoreline Zoning Ordinance, and the New Orleans Coastal Zone Management Plan. Three alternative solutions to environmental control are offered: (1) restrictive height, bulk and area requirements; (2) transfer of development rights; and (3) in lien payments. Legislation recognizing the difference between eminent domain and the police power could solve the problem. (Tabano-Florida)
W80-04786

EMERGING TRENDS IN THE USE OF INTERNATIONAL LAW AND INSTITUTIONS FOR THE MANAGEMENT OF INTERNATIONAL WATER RESOURCES,
Denver Univ., CO.
V. P. Nanda.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 239-261, 1976. 1 Fig.

Descriptors: *Water quality, *Water resources development, *International waters, *International law, United Nations, Water law, Water resources, Water management(Applied), Water quality control, Water sources, International commissions, Governmental interrelations.

In a recent conference, the United Nations concluded that a potential world water crisis exists. Although there appears to be sufficient water, it tends to be available in the wrong place or with the wrong quality. International law and institutions can facilitate the management of international river resources, primarily for non-navigational uses. Unilateral attempts to solve water problems are often limited, since many nations lack adequate data and skill to develop water systems with likely wasteful duplication of effort. Concerted effort is especially necessary for internationally interconnected water resources. General conventions of nations have been held to adopt treaties and statutes. There have also been multilateral, regional, and bilateral conventions, accounting for some 300 agreements between and among states. A large number of intergovernmental organizations have also been actively involved with water resource problems. Scholarly and professional organizations have contributed studies of international watercourses. Emphasis should be taken off sovereignty when dealing with the uses of international waters, and placed upon the interests of the international community as a whole. (Tabano-Florida)
W80-04787

THE MANAGEMENT OF LAND AND WATER USE IN THE COASTAL ZONE: A NEW LAW IS ENACTED IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill.
T. J. Schoenbaum.
The North Carolina Law Review, Vol 53, No 2, p 275-302, December 1974.

Descriptors: *Coastal plains, *Coastal structures, *Land use, *Shore protection, Resources, Admin-

istrative agencies, Water utilization, Permits, Governmental interrelations, Management, Environmental controls, *North Carolina.

In 1974, North Carolina passed the Coastal Area Management Act (Act), initiating a comprehensive program for the management of the land and water resources in its coastal zone. Its major objectives are an instrumental use of law rather than a mere technical statement, and the delegation of substantial discretionary powers to administrative agencies and local government units. Although the process of policy formulation was influenced by federal developments, such as the 1972 Coastal Zone Management Act, the state's law has proceeded independently from the federal effort. The area covered by the Act is extremely broad. The Act institutes comprehensive land and water use planning for the coastal area. Certain lands and waters are designated areas of environmental concern in which no development may be undertaken without a permit. Variances are allowed upon a showing of unnecessary hardship, and certain exemptions and exclusions are allowed. Two procedures for judicial review are available, and public participation in decision-making is required. The local character of the administrative agency, the lack of legal requirements to assure planning implementation, and the exemptions given could subvert the Act's intended operation. (Tabano-Florida)
W80-04788

ONCE-RELEASED IRRIGATION WATERS: LIABILITY AND LITIGATION,
H. Meshorer.
Montana Law Review, Vol 36, No 1, p 14-28, Winter 1975.

Descriptors: *Irrigation effects, *Drainage water, *Seepage control, *Remedies, Legislation, Federal jurisdiction, Judicial decisions, Irrigation engineering, Reclamation, Legal aspects, Irrigation, Water law.

There has been an inevitable outgrowth of the widespread use of irrigation in the western United States. This is litigation regarding damage caused by seepage or drainage of excess waters from government reclamation projects onto adjoining lands. The problems remain unavoidable because of the basic engineering or irrigation, and unsettled due to the relative lack of case law on the subject. Problems are further complicated by the various notions of ownership and resultant liabilities. The most commonly used remedy for the injured landowner is the Federal Tort Claims Act. As an adjunct to tort liability, the doctrine of res ipsa loquitur may be applied. Liability apart from negligence may still exist in the form of the constitutional claim of a taking of property for a public use without just compensation. The remedies available to the landowner whose property is damaged by seeping waters are plainly inadequate. One alternative might be a decision to recognize a form of absolute liability. (Wilson-Florida)
W80-04789

THE ENFORCEMENT OF FEDERAL RECLAMATION LAW IN THE WESTLANDS WATER DISTRICT: A BROKEN PROMISE,
M. L. Frampton.
University of California, Davis, Law Review, Vol 13, No 1, p 89-121, Winter 1979-80.

Descriptors: *Federal reclamation law, *Federal project policy, *Water districts, *California, Reclamation, Agriculture, Irrigation water, Legal aspects, Federal government, Administrative agencies, Water allocation(Policy).

In California's San Joaquin Valley lie more than a half-million acres of rich agricultural land. This ground is made bountiful by irrigation water from the federally constructed San Luis Unit of the Central Valley Project. One consideration for procuring water subsidies from the federal government is the landowners' continuing compliance with federal reclamation statutes. These statutes limit the amount of water an individual may obtain, and require recipients to live on or near their farmland. The purposes of the reclamation law have been continually thwarted in the Westlands Water District. This District supports a mere 216 large farm operations. Small farmers have been frustrated in their attempts to purchase land in the Westlands Water District. Small farmers have challenged the federal administration of reclamation law. Groups have sought injunctions to prevent further excess land sales, pending promulgation of regulations regarding such approvals. However, without a meaningful lottery provision or a realistic residency figure, the new rules would not prevent large group transactions and insider deals that exclude the average family farmer. (Wilson-Florida)
W80-04790

SOIL CONSERVATION AND WATER POLLUTION CONTROL: THE MUDDY RECORD OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
Nebraska Univ., Omaha.
C. L. Williams.
Boston College Environmental Affairs Law Review, Vol 7, No 3, p 365-421, 1979.

Descriptors: *Soil conservation, *Soil erosion, *Water pollution control, *Agricultural runoff, Land use, Agriculture, Federal water pollution control act, Water quality, Administrative agencies, Federal government, Water pollution sources.

Under provisions of Section 208 of the 1972 Federal Water Pollution Control Act Amendments, every state must submit a Water Quality Management Plan. This Plan covers so-called non-designated areas within the state, which must be approved by the federal Environmental Protection Agency (EPA). Since the vast majority of agricultural land in the United States lies in these non-designated areas, virtually all agricultural land may potentially become subject to federally mandated water pollution regulations. There are serious efforts being made to have the administration of Section 208 removed from EPA, as it applies to agriculture, and placed instead in the Department of Agriculture (USDA). With a prominent role in the control of agricultural non-point source pollution virtually assured for the USDA, it is important to examine that agency's past performance regarding the limitation of soil erosion. The USDA's shortcomings in soil conservation have occurred in three areas: (1) program goals; (2) program content; and (3) program administration. Finally, difficulty arises from the nature of the erosion problem itself, for erosion control programs require a great deal of flexibility. (Wilson-Florida)
W80-04791

THE FEDERAL WATER POLLUTION CONTROL ACT - INDUSTRIAL CHALLENGES TO EFFLUENT LIMITATIONS,
J. E. McKinnon.
Boston College Environmental Affairs Law Review, Vol 7, No 4, p 545-566, 1979.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *Waste water(Pollution), Water pollution, Administrative decisions, Effluents, Administrative agencies, Legal aspects, Regulation, Decision making, Discharge(Water).

Under the 1972 Federal Water Pollution Control Act Amendments (Act) every industry that discharges waste water must meet effluent limitations promulgated by the federal Environmental Protection Agency (EPA). This mandate has spawned legal challenges to effluent limitations. The different types of industrial challenges to effluent limitations are described. The three main categories of challenges are procedural, statutory and substantive. Procedural challenges concern the EPA's failure to satisfy fair notice requirements. Statutory challenges involve attacks on the EPA's interpretation of the Act. Substantive challenges concern the EPA's judgment in developing effluent limitations. The legal standards that these effluent limitations must meet in order to withstand such judicial challenges are outlined. Strict enforcement of the fair notice requirement is the best way to ensure fair regulation and decrease procedural challenges. Substantive challenges may be expected to make up the bulk of future challenges. If the EPA can show, through the administrative record, that adequate consideration was given to all relevant factors and that it has noted on correct data in setting effluent limitations, these challenges will likely fail. (Daniels-Florida)
W80-04792

THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978: BALANCING ENERGY NEEDS WITH ENVIRONMENTAL CONCERNS,
G. L. James.
Louisiana Law Review, Vol 40, No 1, p 177-206, Fall 1979.

Descriptors: *Continental shelf, *Oil fields, *Oil pollution, *Resources development, Gasoline, Oil, Environment, Leases, Sites, Governmental interrelations, Oil spills, Management, Drilling.

In 1977 Congress amended the Outer Continental Shelf Lands Act (Act) in order to expedite the development and production of continental shelf oil and gas, and to provide adequate protection to the coastal environment. This comment addresses these amendments by first presenting the Act's background and other major federal regulatory legislation are discussed. The amendments are discussed as they relate to three different stages of the leasing process. Stage one, site selection, deals with different factors involved in the selection process. Exploration and development is also mentioned, with a review of state and local government participation in the program. Stage two, management, covers the suspension and cancellation of leases, air emission standards, and improvement of drilling technology. The third stage, enforcement, reviews the role of the federal agencies, liability, and damages recovery in the event of an oil spill. A balance between the need for future energy supplies and the importance of environmental protection must be struck in order that the United States may depend less on foreign oil sources and yet preserve its aesthetic quality. (Tabano-Florida)
W80-04793

NEED FOR A UNIFORM PUBLIC - PRIVATE BOUNDARY: APPLICATION OF THE HIGH WATER BOUNDARY TO INLAND NAVIGABLE LAKES,
K. S. Beaumont, and L. Libby-Nelson.
University of California, Davis, Law Review, Vol 12, No 1, p 125-164, March 1979.

Descriptors: *Boundaries(Property), *Boundary disputes, *High water mark, *Navigable waters, Riparian land, Riparian rights, Compensation, Water injury, Water law, Water level fluctuations, Flooding, Submergence.

Private riparian owners and the state of California are currently arguing over the boundary line separating state from private ownership on navigable lakes. The state asserts title to the high water mark while the private owners claim to the low water mark. A resolution of the public-private boundary conflict in California's navigable lakes is proposed. The ordinary high water line is asserted as the true boundary. The background and use of this line is thoroughly discussed. Explicit adoption of a high water boundary would not result in a compensable taking of private property. Artificial regulation of the water level in relation to the boundary question is also discussed. It is felt that the boundary should follow the new high water mark, even though the state has caused the increase. The issue of whether the state should compensate owners for riparian land which becomes submerged or flooded due to state action is also considered. (Tabano-Florida)
W80-04794

WRECK REMOVAL; STATUTORY RESTRICTIONS; RIVERS AND HARBORS ACT,
A. J. Blank, Jr.
Tulane Law Review, Vol 53, No 4, p 1299-1327, June 1979.

Descriptors: *Rivers and Harbors Act, *Coast guard regulations, *Water pollution control, Judi-

cial decisions, Legislation, Ships, Remedies, Federal government, Watercourses(Legal aspects), Navigation, *Shipwreck removal.

Although the present federal Wreck Statute governing wreck removal has been in existence since 1899, the first significant analysis of it by the Supreme Court did not occur until 1967 in Wyondotte Transportation Co. v. United States. Recent court decisions have been in favor of the rights and remedies of the government against both the negligent wreck owner, the negligent non-owner who caused or contributed to the wreck sinking. Although the Wreck Act (Act) is not a model of clarity, it is evident that none of its sections include any personal remedies; rather they include only property remedies. Section 15 of the Act has been construed to place on the owner of a wreck, whether negligent or not, a continuous duty to locate and mark his wreck. An element of uncertainty has existed as to when and if owners were relieved of this duty by the intervention of the Coast Guard. The condemnation in the Wyandotte case of negligent parties, and its rejection of their right of abandonment, exposes such parties to unlimited personal liability for removal costs. (Wilson-Florida)
W80-04795

FEDERAL PROTECTION OF WETLANDS THROUGH LEGAL PROCESS,
C. B. Myhrum.
Boston College Environmental Affairs Law Review, Vol 7, No 4, p 567-627, 1979.

Descriptors: *Wetlands, *Federal Water Pollution Control Act, *Water quality control, Environmental control, Regulation, Legislation, State governments, Navigable waters, Rivers and Harbors act, Environment, Federal government.

Wetland protection is viewed as a vitally important priority in the effort to restore and maintain water quality and preserve natural hydrologic cycles. The problem of arriving at an exact definition of wetlands and their importance in the ecosystem are discussed. An analysis of certain state regulatory efforts shows the shortcomings of state pollution control strategies and the necessity for federal regulation in this area. A historical perspective covers the term 'navigable waters' and the 1899 Rivers and Harbors Act. The enactment of Section 404 of the Federal Water Pollution Control Act is discussed emphasizing statutory drafting mistakes that caused a dispute between the Environmental Protection Agency and the Army Corps of Engineers. The resulting litigation brought about an expansion of Section 404. The elements of this new program especially significant to wetland protection is discussed. The Congressional activity involved in the evolution of Section 404 is examined with emphasis on its expansive revisions. This growing awareness of the value of wetlands will aid in maintaining an ecologically balanced environment. (Tabano-Florida)
W80-04796

THE MUNICIPAL PROGRAM OF THE CLEAN WATER ACT: 1978 ADMINISTRATIVE IMPLEMENTATION,
T. S. James, Jr.
The Harvard Environmental Law Review, Vol 3, p 326-346, 1979.

Descriptors: *Municipal wastes, *Construction costs, *Treatment facilities, Grants, Discharge(Water), Federal government, Public utilities, Treatment, Governmental interrelations, Cost analysis, Technology.

In 1978, the federal Environmental Protection Agency (EPA) promulgated regulations to implement the 1977 Clean Water Act (Act). These regulations embody important insights gained from the EPA's evaluation of the municipal program. The program goals were changed to extend the statutory deadline for all municipal point sources and to provide an exception for discharges into marine waters. The Construction Grants Program, which provides federal assistance for construction of publicly-owned treatment works, also underwent changes. Responsibilities were decentralized from the EPA to the states and local governments. The categories of eligible construction costs were expanded. Special Funding Programs were implemented, providing grants for innovative and alternative technology. Cost-Effectiveness Analysis Guidelines and Reserve Capacity Regulations were promulgated to promote efficiency. Combined grants were also made available to certain communities for preparing construction plans and specifications and for building the treatment works. All of these changes promote a balance of the Act's varied objectives. (Tabano-Florida)
W80-04797

REPORT TO GOVERNOR JOHN A. LOVE ON CERTAIN COLORADO WATER LAW PROBLEMS,
Holland and Hart, Denver, CO.
J. U. Carlson.
Denver Law Journal, Vol 50, No 3, p 293-350, 1973.

Descriptors: *Colorado, *Prior appropriation, *Water allocation(Policy), *Water demand, Diversion, Environmental effects, Water law, Water rights, Water resources development, State government, Legal aspects, Water management(Applied).

In a semi-arid state like Colorado, the importance of water and its uses are obvious. As this resource approaches full utilization, concern that social and environmental values be protected becomes paramount. The resolution of these concerns is complicated by a system of water law rooted in the state constitution. The doctrine of prior appropriation was law in Colorado before statehood, and the constitution of 1876 confirmed prior appropriation as the state's fundamental water law. In the early development of prior appropriation law, it was clear that a judicial decree did not create the water right; the right was created by diversion of water and its application to beneficial use. The increasing demand for water and the scarcity of further unappropriated waters point to increasing market pressure on existing, decreed rights. The doctrine of prior appropriation contemplates the full use of all the state's water. The favored uses are traditional consumptions for economic development. Full consumptive use may serve goals of economic development at the expense of scenic, aesthetic and environmental values. (Wilson-Florida)
W80-04798

VESSEL-SOURCE OIL POLLUTION: LEGAL, ADMINISTRATIVE AND TECHNICAL ASPECTS OF A GLOBAL ENVIRONMENTAL PROBLEM,
R. A. Kriscunas.
Comparative Law Yearbook, Vol 2, p 237-284, 1978.

Descriptors: *International waters, *Oil spills, *Oceans, *International Boundary and Water Commission, International law, Water pollution, Oil pollution, International commissions, Legal aspects, Marine biology, Environmental effects, Environmental control.

The reader is given an understanding of the legitimate ecological issues raised by the maritime transportation of oil. An up-to-date explanation is provided of the control measures being utilized by the international community to curtail vessel-source oil pollution. The various national and regional approaches to this essentially 'extraterritorial' pollution phenomena are surveyed. Examined in detail are a variety of proposals for improving the development and enforcement of international and national standards for the prevention of vessel-source pollution. Included are the 1974 Baltic Convention, the Third United Nations Conference on the Law of the Sea, the 1973 Marine Pollution Convention, and others. Individual states lack standing to complain about all but a minimal number of water-based and land-based pollution activities. Furthermore, shipowner or even cargo-owner liability is not a deterrent to pollution. There is a need for a comprehensive ocean protection constitution. Essential elements for a proposal in the immediate future are suggested. (Schwerer-Florida)
W80-04799

PREVENTING GROUNDWATER POLLUTION: TOWARDS A COORDINATED STRATEGY TO PROTECT CRITICAL RECHARGE ZONES,
Environmental Defense Fund, Inc., Washington, DC.
J. T. B. Tripp, and A. B. Jaffe.
The Harvard Environmental Law Review, Vol 3, p 1-47, 1979.

Descriptors: *Groundwater, *Pollution abatement, *Groundwater recharge, Federal government, Federal Water Pollution Control Act, Water pollution, Water management(Applied), Legislation, Legal aspects, Water supply.

To be effective, groundwater management requires coordinated action by all levels of government and a broad arsenal of legal tools, including regulation of land use. The nature of groundwater and groundwater pollution, and the legal framework upon which control must be based are examined. Federal, state, and local legislation is analyzed, including four case studies utilizing programs based on non-degradation and recharge zone protection. The case studies illustrate both the possibilities and the difficulties of implementing such an approach. Although specific problems of assuring adequate water quantity are not addressed, the problems of pollution control measures aggravating depletion and depletion control measures worsening pollution are examined. An overall management approach to groundwater pollution is suggested, with primary responsibility for groundwater protection in the states and localities. This is based on the apparent confusion in federal programs, and the ineffectiveness of regulation under the Safe Drinking Water Act and other federally administered programs. The ineffectiveness of federal programs regulating groundwater pollution is analyzed. Possible amendments and proposals are suggested. (Schwerer-Florida)
W80-04800

6F. Nonstructural Alternatives

COASTAL ZONE MANAGEMENT - A FEDERAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W80-04583

SHORELAND ZONING IN MAINE,
Maine Univ. at Orono.
For primary bibliographic entry see Field 6E.
W80-04585

COASTAL ZONE MANAGEMENT - A NEW APPROACH IN CALIFORNIA,
For primary bibliographic entry see Field 6E.
W80-04586

ESTIMATING COSTS AND BENEFITS FOR NONSTRUCTURAL FLOOD CONTROL MEASURES,
Hydrologic Engineering Center, Davis, CA.
W. D. Carson.
October 1975. 115 p, 7 Fig, 18 Tab, 40 Ref.

Descriptors: *Flood control, *Floodproofing, *Non-structural alternatives, *Regulation, *Relocation, *Land use, *Cost-benefit analysis, *Evaluation, Flood protection, Flood plain zoning, Zoning, Building codes, Benefits, Project benefits, Project planning, Computer models, Computer program, Linear programming, Flood damage, Damages.

This report evaluates three nonstructural flood control measures: flood-proofing, evacuation-relocation and land use regulations. Floodproofing is an adjustment to a structure or its contents, or both, such that either water is kept from the structure or the damaging effects of water entry are

eliminated or reduced. Evacuation-relocation involves the physical and permanent evacuation of activities and people from the floodplain to sites where the flood hazard is lower. Land use regulation attempts to direct future land use in such a way that it is consistent with the flood hazard. Estimates of the cost of floodproofing would be made by examining different designs for each structure and choosing the least expensive to add into the total cost. Two distinctive cost categories can be considered for evacuation-relocation: (1) physical costs of carrying out the program, and (2) loss of income occasioned by the relocation of the activity away from the location chosen in the market. The measurement of the costs of land use regulation requires projection of future development which will occur in the floodplain and determining what costs are incurred by excluding this projected development from the floodplain. These three measures create inundation reduction benefits by lowering the damage susceptibility of individual structures or of the aggregate of structures on the floodplain. Intensification benefits occur when an activity is allowed, or induced, to intensify its operation as a result of a flood control program. Tools for evaluating nonstructural measures include (1) Hydrological Engineering Center (HEC)-5C-Simulation of Flood Control and Conservation Systems; (2) Day-Weisz Model; (3) INTASA Simulator; and (4) HEC-DAMCAL. These tools are either computer programs or linear programming models. (Iervolino-NC)
W80-04769

THE MANAGEMENT OF LAND AND WATER USE IN THE COASTAL ZONE: A NEW LAW IS ENACTED IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill.
For primary bibliographic entry see Field 6E.
W80-04788

6G. Ecologic Impact Of Water Development

PHEASANT USE OF WETLANDS DURING THE WINTER AND APPLICATION OF LANDSAT IMAGERY FOR ASSESSING WINTER HABITAT,
South Dakota State Univ., Brookings. Dept. of Wildlife and Fisheries.
S. Sather-Blair, R. L. Linder, and D. G. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170616, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Institute, South Dakota State University, February 1980. 53 p, 8 Fig, 18 Tab, 18 Ref. OWRT A-062-SDAK(1), 14-34-0001-7088.

Descriptors: *Wetlands, Vegetation, Remote sensing, Land use, *Game birds, Winter, *South Dakota, *Pheasant, Infrared photography.

This study was designed to investigate (1) vegetative factors influencing ring-necked pheasant (Phasianus colchicus) use of wetlands during the winter, (2) the relationship of land use practices adjacent to wetlands and the use of such wetlands as winter cover by pheasants, and (3) the feasibility of assessing wetlands as pheasant winter habitat through the use of remote sensing data. Fifteen wetlands in Windsor Township, Brookings County, South Dakota, were randomly selected for study to estimate their use by pheasants. Use of cover types was analyzed by using multiple regression, chi-square, and t-tests. Correlation matrices were generated to locate significant relationships. Pheasant use of wetlands was analyzed using multiple regression. Height was the most important vegetative factor influencing loafing site selection. Shrubs were highly preferred over other cover types for loafing. Trees, phragmites (Phragmites communis), and cattails (Typha latifolia) were also used regularly. Smartweeds (Polygonum coccineum), roundstem bulrushes (Scirpus acutus and Scirpus validus), and grasses were seldom used. Density was the most important vegetative factor influencing selection of roots sites by pheasants. Most roots were in cattails while phragmites had the greatest relative number of roots. Size of wetland and the presence of emergency cover around the wetland were the most important factors influencing degree of pheasant use. Wetlands consistently used by pheasants were either large dense cattail wetlands or had considerable shrub growth. The small wetlands with no shrub growth filled with snow early and were not utilized. (Wiersma-South Dakota)
W80-04544

THE COASTAL ZONE MANAGEMENT ACT AMENDMENTS OF 1976,
For primary bibliographic entry see Field 6E.
W80-04784

FEDERAL PROTECTION OF WETLANDS THROUGH LEGAL PROCESS,
For primary bibliographic entry see Field 6E.
W80-04796

7. RESOURCES DATA

7B. Data Acquisition

IN SEARCH OF WETLANDS,
R. Nyc.
Water Spectrum, Vol 12, No 2, p 17-25, Spring 1980. 9 Fig, 1 Tab, 2 Ref.

Descriptors: *Wetlands, *Surveys, *Mapping, *Terrain analysis, Classification, Systematics, Aerial photography, Remote sensing, Wildlife, Census, Swamps, Bogs, Aquatic habitats, Marshes, Fen.

Stereoscopic interpretation of high quality, small scale, aerial photography is being used to produce maps for the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI). So that the inventory will be consistent nationwide, old terms such as bogs, marshes, fens, and swamps are not used in the new classification system. The NWI system has five broad ecological systems that have hierarchical structures to describe hydrological, biological and physical aspects of wetland areas. Other elements allowed in the system include modifiers for water regime, water chemistry, soils, and man-influence. For mapping, each element in the system is assigned a letter or number and an alpha-numeric composite code is used to identify a particular wetland. Depending on the availability of base maps two types of inventory maps are being produced: large scale maps (1:24,000 or 1:62,500), and small scale maps (1:100,000). Transitional zones, areas where wetland and upland plants share common ground, are also included in the inventory. No attempt is made by the NWI to define limits of proprietary jurisdiction of regulatory agencies. To check map accuracy field review is conducted by the Corps of Engineers. The smallest wetland mapped is between one and five acres although in some areas greater detail is possible. A Wetland Analytical Mapping System is planned to produce digitized wetland information directly from aerial photographs which will be even more accurate than the current cartographic procedure. (Seigler-IPA)
W80-04507

DOWSERS WIELD WEIRD WANDS: IS IT SCIENCE, ART OR MAGIC,
R. Wolkomir.
Science Digest, p 66-71, March, 1978.

Descriptors: *Ground water, *Exploration, Remote sensing, Subsurface investigations, Electromagnetic waves.

Interest in dowsing is on the increase but many scientists remain skeptical. Several studies have put the success rate for dowsed wells and undowsed wells about the same. One study at Harvard University concluded that dowsers unconsciously move the rods themselves by minute muscular responses to subliminal geological clues to ground water. Other researchers have found that dowsers are sensitive to changes in electro-magnetic fields. However, this sensitivity does not explain other dowser claims such as the ability to locate ground water using maps, or the ability to change the direction of ground water flow. The U.S. Geological Survey, after having examined the literature and the results of scientifically controlled experiments on dowsing, has concluded that the expense of further tests of water dowsing is not justified. (Purdin-NWWA)
W80-04522

A SIMPLE DIGITAL RATE-METER FOR CURRENT METERS (NOTE),
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
M. M. Gibbs.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 55-58, 1979. 2 Fig, 1 Ref.

Descriptors: *Current meters, *Automatic control, *Automation, *Instrumentation, Equipment, Design, Currents(Water), Flow, On-site investigations, Measurement, Hydrology, Streamflow, *Flow measurement.

Current meters are frequently used in the gaging of streams and rivers; these instruments emit one or more pulses per revolution of the rotor, pulses which the operator hears in an earphone and must count over a timed period. While counting at low speeds presents no problems, errors can occur when the currents are fast or the operator is tired. The device described in this paper was designed to reduce counting errors and make gaging easier. It provides an accurate count, even at rates greater than 20 counts per second, automatically stopping after a preselected time period. It has proved easy to use and reliable, and is both light and compact enough to be hung around the operator's neck, thus leaving his hands free. (Sims-ISWS)
W80-04537

INSTANTANEOUS RAINFALL RATE: ITS MEASUREMENT AND ITS INFLUENCE ON HIGH-VOLTAGE TRANSMISSION LINES,
American Electric Power, North Liberty, IN.
H. Kirkham.
Journal of Applied Meteorology, Vol 19, No 1, p 35-40, January 1980. 8 Fig, 3 Ref.

Descriptors: *Rainfall, *Rainfall intensity, *Rain gages, *Electric power, Measurement, Equipment, Electrical coronas, Transmission lines, Transmission(Electrical), Precipitation(Atmospheric), Meteorology, Engineering, Electrical engineering.

When a high-voltage transmission line is exposed to rain, there is generally a small amount of corona activity at the surface of the conductors. This activity usually results in a power loss and the generation of audible and radio noise. While the power loss is generally very small compared to the power transmitted, it is possible to measure it on short test lines where no power is carried through the line. It has been found that there are variations in the power loss, and to a lesser extent in the audible and radio noise, during a typical rainstorm. These variations have been ascribed to variations in the instantaneous rainfall rate. An instrument was developed to measure the instantaneous rainfall rate. The results confirm, in fact, that most of the variations in the corona parameters can be attributed to variations in the instantaneous rainfall rate, although the relationships are not simply linear. The instrument was described in this paper, and some of the results showing the correlation between rainfall rate and the corona loss and audible noise from an ultra-high voltage test line in northern Indiana were presented. (Sims-ISWS)
W80-04538

SIMPLE FIELD METHODS FOR ESTIMATING SOIL HYDRAULIC CONDUCTIVITY,
Sao Paulo Univ. (Brazil). Center for Nuclear Energy in Agriculture.
P. L. Libardi, K. Reichardt, D. R. Nielsen, and J. W. Biggar.
Soil Science Society of America Journal, Vol 44, No 1, p 3-7, January-February 1980. 4 Fig, 2 Tab, 10 Ref.

Descriptors: *Hydraulic conductivity, *Soil physical properties, *Methodology, *Moisture content, On-site tests, Soil water movement, Infiltration, Steady flow, Spatial distribution, Soil water redistribution.

Soil water content profiles monitored as a function of time following steady-state infiltration conditions in a field soil provide the only data necessary to estimate the soil hydraulic conductivity as a function of soil water content. For two proposed methods, it is assumed that water redistributes only in response to the gravitational field and that the hydraulic conductivity is an exponential function of soil water content. Experiments were conducted on three fallow field soils covered with plastic to prevent evaporation and sampled to depths of nearly 2 m. Values of hydraulic conductivity calculated by both the two proposed methods as well as by a third recently reported method were compared with those calculated by integrating Richards' equation without simplifying assumptions. Although the above comparisons at given sites within a field revealed that the three methods may sometimes yield poor estimates of the hydraulic conductivity, distributions of observed values averaged over the entire field were statistically comparable for 20 observations. It was concluded that a greater number of observations made possible by simplifying assumptions, and hence, less instrumentation and cost, is preferable to fewer observations with more exact methods that are not as amenable to statistical analyses over larger land areas. (Visocky-ISWS)
W80-04540

AN AUTOMATIC ELECTRICAL RESISTANCE SOIL-MOISTURE MEASURING SYSTEM,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 2G.
W80-04622

A STUDY OF STRONTIUM-90 MOVEMENT IN A SANDY SOIL,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service de Radio-Agronomie.
P. Couchat, F. Brissaud, and J. P. Gayraud.
Soil Science Society of America Journal, Vol 44, No 1, p 7-13, January-February 1980. 6 Fig, 3 Tab, 18 Ref.

Descriptors: *Strontium, *Dispersion, *Soils, *Adsorption, *Leaching, Solutes, Tracers, Radioisotopes, Sands, Pore water, Velocity, Hysteresis, Calcium, Desorption, Shaking, Soil columns, CSMP(Continuous System Modeling Program).

Different methods were used to describe 90Sr movement in a Montpellier sandy soil at a pore water velocity of about 0.1 cm/sec. Shaking tests showed that the adsorption and the desorption of 90Sr on this soil material may be considered as instantaneous and that the equilibrium adsorption-desorption relation was hysteretic. However, adsorption-desorption data obtained from material balance calculations on effluent data from soil columns did not agree with those obtained from shaking tests. This difference was confirmed by comparison of measured breakthrough curves for 90Sr and tritiated water with those calculated using equilibrium isotherms obtained from shaking tests. Equilibrium adsorption-desorption isotherms obtained from fitting of experimental breakthrough curves by a S/360 CSMP simulation model agreed well with the experimental data derived from the material balance method. The results show that isotherms from shaking tests overestimate the effect of 90Sr adsorption-desorption during transport. The hysteresis effect was less pronounced in the data obtained by the material balance method, and it was shown that an approximating, linear, nonhysteretic adsorption-desorption isotherm adequately described for practical purposes the leaching of 90Sr in the sandy soil. (Visocky-ISWS)
W80-04637

DESK TOP METHODOLOGY FOR MODELING BIOCHEMICAL OXYGEN DEMAND IN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176142, Price codes: A02 in paper copy, A01 in microfiche. Partial completion report, April 1980. 16 p. OWRT A-046-NJ(4), 14-34-0001-9032.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Mathematical models, Organic matter, Oxygen sag, Water pollution, Water quality, Streams.

The modeling of dissolved oxygen as widely practiced involves considerable uncertainties due partly to the assumptions not fully represented by the model and also, usually great deficiencies in data. The diurnal fluctuation of oxygen complicates the water. Methods are presented and illustrated for modeling the BOD process instead, and later calculating the critical oxygen condition at the sag point only. The necessary computations can be made by hand calculator, and used quickly to check validity of data.
W80-04673

EXOTIC TECHNIQUES HELP DRILLERS.
Drilling Contractor, Vol 36, No 3, p 21-22, March, 1980. 3 Fig.

Descriptors: *Drilling equipment, *Drilling fluids, *Telemetry, Logging instrumentation, Electronic equipment, Boreholes, Rotary drilling, Downhole motors.

New developments in drilling technology are described. A wire telemetry system stores logging cable in a long loop inside drill pipe. The loop rotates with the drill pipe and the cable is withdrawn as the drill string lengthens. The electronic package can reliably withstand the rigors of bottom-hole drilling conditions. For certain formations the use of air, mist, or foam as drilling fluids can result in considerable economic advantage over liquid mud systems in terms of penetration rate and bit life. A dual string-airlift reverse circulation method was used to drill 120-inch holes at the Nevada Test Site. The mechanics of this method are based on the principles of air-lift pumping. Air and fluid are introduced in the annulus between the drill pipe and inner string. Drilling fluids exit through the bit jets to clean the bottom of the hole and air exits through the air jets to provide the required air lift for the fluid and cuttings. An advanced well drilling method, called Electrodrill, includes a downhole electric drill motor and electronic sensor plus telemetric package linked to the surface with a cable/connector conductor system, power generation and regulation equipment. (Purdin-NWWA)
W80-04774

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1978.
Geological Survey, Albuquerque, NM. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160864, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NM-78-1, September 1979. 677 p, 6 Fig, 3 Tab.

Descriptors: *New Mexico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 229 gaging stations; stage and contents for 24 lakes and reservoirs; water quality for 89 gaging stations, 15 partial-record stations, 2 reservoirs, 3 springs and 99 wells; and water levels for 96 observation wells. Also included are 144 crest-stage partial-record stations and 2 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Mexico. (Kosco-USGS)
W80-04547

WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1978.
Geological Survey, Little Rock, AR. Water Resources Div.
Geological Survey Water-Data Report AR-78-1, September 1979. 668 p, 5 Fig, 3 Tab.

Descriptors: *Arkansas, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Arkansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 75 gaging stations; stage only records for 1 gaging station; stage and contents for 10 lakes and reservoirs; water quality for 156 stations, 85 partial-record flow stations, and seven lakes; and water levels for 91 observation wells. Also included are 122 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas. (Kosco-USGS)
W80-04548

WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1978.
Geological Survey, Jackson, MS. Water Resources Div.
Geological Survey Water-Data Report MS-78-1, February 1980. 507 p, 5 Fig.

Descriptors: *Mississippi, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Mississippi consist of records of stage and discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of wells. This report contains discharge records for 82 gaging stations, stage records for 15 of these gaging stations. Stage only for 3 gaging stations, contents for 4 lakes, water quality for 25 gaging stations, and 164 wells, and water levels for 175 observation wells. Also included are data for 92 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Mississippi. (Kosco-USGS)
W80-04549

WATER-QUALITY DATA FOR THE HANNA AND CARBON BASINS, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
P. B. Freudenthal.
Available from: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225, paper copy $6.00, micro-

fiche $3.50. Geological Survey open-file report 79-1277, August 1979. 41 p, 4 Fig, 7 Tab, 10 Ref.

Descriptors: *Water quality, *Hydrologic data, *Wyoming, *Groundwater, *Surface waters, Data collections, Sites, Gaging stations, Water wells, Sampling, Sediment load, Chemical analysis, Water analysis, Trace elements, Radiochemical analysis, *Hanna Basin(Wyo), *Carbon Basin(Wyo).

Water-quality data for the Hanna and Carbon Basins, south-central Wyoming, are presented in tables with no interpretation. Common-constituent, trace-element, and radiochemical data for ground and surface water and sediment concentrations for surface water are included. Ground water at 53 sites and surface water at 3 gaging stations were sampled. (Kosco-USGS)
W80-04560

GROUND-WATER BASIC DATA FOR RANSOM AND SARGENT COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
North Dakota County Ground-Water Studies 31--Part II, and North Dakota Geological Survey Bulletin 69-Part II, 1979. 637 p, 2 Fig, 1 Plate, 5 Tab, 21 Ref.

Descriptors: *Groundwater, *Basic data collections, *North Dakota, *Groundwater availability, *Water quality, Aquifers, Water wells, Logging(Recording), Observation wells, Well data, Chemical analysis, Groundwater movement, Mineralogy, Water properties, Potential water supply, Water utilization, Ransom County(N Dak), Sargent County(N Dak).

This report contains hydrologic data for wells and test holes in Ransom and Sargent Counties, N. Dak. Included are logs of test holes and wells, chemical analyses of water samples, chemical analyses of minor elements in ground water, and water-level measurements in observation wells. The data are useful for evaluating ground-water and geologic conditions in Ransom and Sargent Counties. (Kosco-USGS)
W80-04564

HYDROGEOLOGY OF THE PEERLESS LAKE AREA, ALBERTA,
Research Council of Alberta, Edmonton.
W. Ceroici.
Earth Sciences Report 79-5, 1979. 10 p, 2 Fig, 1 Tab, 13 Ref, 1 Append, 1 Map.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, *Canada, *Data collections, Aquifer characteristics, Geology, Groundwater movement, Water quality, Calcium, Magnesium, Lakes, Stratigraphy, Hydrologic aspects, Artesian aquifers, Water yield, Alluvial aquifers, Vegetation, Topography, Climatology, *Alberta, *Peerless Lake(Alberta).

The Peerless Lake map area (NTS 84B), situated in north-central Alberta, is bounded by longitudes 114 deg and 116 deg west and latitudes 56 deg and 57 deg north. Total area is approximately 13,000 sq km. The area is sparsely populated and access is poor. The area is covered by thick surficial deposits, primarily of glacial origin, overlying Cretaceous shales. Yields of up to 38 L/s (500 igpm) may be obtained from glaciofluvial deposits. The greatest yields are available from preglacial sands and gravels located in portions of the Misaw and Atikameg Buried Valleys. In general, the bedrock is a poor aquifer yielding usually less than 0.4 L/s (5 igpm). Groundwater from surficial deposits is predominantly the calcium/magnesium-bicarbonate type with an average total dissolved solids concentration of 1000 mg/L. Muskeg waters chemically resemble waters from surficial deposits, but total dissolved solids concentration rarely exceeds 250 mg/L. Bedrock groundwaters are the sodium/potassium-chloride type with an average total dissolved solids concentration of over 2000 mg/L. (Humphreys-ISWS)
W80-04646

AIDS FOR DOCUMENTING FIELD DATA,
Hydro-Search, Inc., Denver, CO.
L. C. Atkinson.
Ground Water, Vol 18, No 1, p 70-76, January-February, 1980.

Descriptors: *Drilling logs, *Data collections, *Well data, *Documentation measurement, Monitoring, Sampling, Analysis, Charts, Investigations, Hydrologic data, Water quality, Water levels, Water wells.

Field data forms for aquifer tests, water level measurement, borehole logs, well construction summaries, and water quality sampling and analysis are described. The borehole logs records standard, basic geologic information, as well as parameters specifically relevant to boreholes used for exploration or water supply. The well construction summary provides a concise, comprehensive documentation of the drilling, design, construction, and development of a water well. The aquifer test form records data from both pumping and observation wells during the pumping and/or recovery portions of an aquifer test. The water level data form is used to record water levels in wells as part of monitoring programs, well inventories, etc. It can record time versus water level for a single well or water levels in numerous wells on a single date. The field water quality sampling and analysis form records basic field water chemistry data, and sampling and preparation/preservation techniques. It can be used for sampling and analysis of both ground and surface water and for recording any variations in water quality parameters during an aquifer test. (Purdin-NWWA)
W80-04676

8. ENGINEERING WORKS

8A. Structures

BROAD-CRESTED WEIRS FOR PORTABLE FLOW METERING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
J. A. Replogle, and A. J. Clemmens.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1324-1328, November-December 1979. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Weirs, *On-site investigations, *Critical flow, *Discharge measurement, *Irrigation canals, Flow measurement, Hydraulics, Open channel flow, Submergence, Design, Hydraulic engineering, *Broad-crested weirs, Portable measuring flumes.

A portable flume was developed to measure flow rates in standard concrete slip-form irrigation canals with a 0.305-m (1 ft) bottom width and 1:1 side slopes. The flume weighs less than 14 kg (30 lb) and would fit in a 0.915-m (3-ft) cube. The flume resembles a broad-crested weir with only two finished surfaces: a long, flat weir crest and a rounded approach ramp. The flume calibration was derived from a mathematical model that has been verified by laboratory testing. The flow depth upstream from the weir is translated to a point above the flume throat, making it relatively insensitive to leveling inaccuracies. This device makes flow measurement both fast (typically 5 to 10 min) and accurate (within + or - 2%). (Adams-ISWS)
W80-04527

WATER RESOURCES DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04594

DESIGN OF GRAVEL PACKS IN DEVIATED WELLBORES,
Exxon Production Research Co., Houston, TX.
C. Gruesbeck, W. M. Salathiel, and E. E. Echols.
Journal of Petroleum Technology, Vol 31, No 1, p 109-115, January 1979. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Boreholes, *Gravels, *Well filters, Well screens, Slurries, Laboratory tests, Model studies, Lysimeters, Mathematical models, Velocity, Pressure head.

Deviated borehole often have unstable or incomplete placement of gravel around the screen and result in sand production. The process by which gravel is transported in deviated wells is described on the basis of observations made while gravel packing small-scale laboratory models. A new design technique is derived that can predict whether a set of design conditions will result in a complete gravel pack that fills the entire borehole-screen annulus. Two experimental relationships which determine the correct design conditions are: (1) the equilibrium velocity necessary to prevent particle deposition in the casing screen annulus, and (2) the incremental pressure gradient caused by the solids in the flowing particle slurry. Experimental relationships for the equilibrium velocity and the pressure gradient of particle slurries were combined with steady state mass and momentum balances to develop a mathematical model of the gravel placement process. The predictions of the model were verified in full-scale gravel-packing studies. Twenty deviated boreholes with angles of deviation from 45 to 62 degrees and with lengths ranging from 40 to 240 ft have been successfully gravel packed using this technique. (Purdin-NWWA)
W80-04631

WELL GROUTING AND CASING TEMPERATURE INCREASES,
Auburn Univ., AL. Dept. of Civil Engineering.
R. C. Johnson, Jr., C. E. Kurt, and G. F. Dunham, Jr.
Ground Water, Vol 18, No 1, p 7-13, January-February, 1980. 13 Fig, 1 Tab, 7 Ref.

Descriptors: *Cement grouting, *Water wells, *Well casing, *Temperature, Plastic pipe, Heat resistance, Portland cements, Laboratory tests, Hydration, Heat, Curing, Deformation, Collapse.

When Portland cement-based grouts cure, a by product of the process is the heat of hydration which may result in deformation and premature collapse of thermoplastic well casing. Since each type of thermoplastic casing has specified temperature limits, it is important to know the range of temperature increases that might occur during grouting. A series of laboratory experiments was performed to determine these temperature increases. The Type I Portland cement used in the experiments was found to produce a higher peak temperature than a similar mix containing 2 percent calcium chloride. For nominal 1 1/2-inch grout thickness, temperature increases between 17 F and 25 F were achieved. With a 3 5/8-inch grout thickness, peak temperature increased to 67F. Where thick grout envelopes occur as a result of caving within the borehole, temperature increases on the order of 170-190F can be expected. Casing temperature usually reaches a peak 8-10 hours after water was added to the cement and remained near the peak temperature for several hours before returning to the original temperature. The ratios of the grout-soil interface surface area and the grout-casing interface area to the grout volume significantly influences the peak casing temperatures. Small-diameter casings have higher peak temperatures than large diameter casing. (Purdin-NWWA)
W80-04650

EVALUATION AND DESIGN OF DOWNHOLE HEAT EXCHANGERS FOR DIRECT APPLICATION,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8C.
W80-04764

DESIGN OF WASTEWATER TREATMENT FACILITIES, MAJOR SYSTEMS.
Office of the Chief of Engineers (Army), Washington, DC.
Engineering Manual EM-1110-2-501, Part 1 of 3, September 1978. 747 p, 44 Fig, 44 Tab, 255 Ref, 1

Append. EM 1110-2-501.

Descriptors: *Wastewater treatment, *Physical processes, *Biological processes, *Chemical processes, *Design criteria, *Wastewater treatment facilities, Treatment, Wastewater disposal, Waste disposal, Waste treatment, Tertiary treatment, Sewage treatment, Biological treatment, Design, Urbanization.

This manual provides guidance for the selection of wastewater treatment systems and processes and criteria for the design of wastewater treatment facilities in urban areas. Part One serves to familiarize the designer with the practical and theoretical aspects of physical, chemical, and biological processes and process trains for urban-type facilities ranging from simple to complex systems, including tertiary systems for nutrient removal. The physical unit processes discussed include grit removal, screening, commination, equalization, flotation, thickening (gravity), sedimentation (primary and secondary clarifier), filtration, vacuum filtration, centrifugation, microscreening, drying beds, postaeration, sludge hauling and landfilling, multiple-hearth incineration and fluidized bed incineration. The chemical unit processes discussed are carbon absorption, chemical coagulation, ammonia stripping, chlorination, ion exchange, neutralization, recarbination and two-stage lime treatment. The biological unit processes described are trickling filters, plug flow activated sludge, complex mix activated sludge, step aeration activated sludge, extended aeration activated sludge, modified or high-rate aeration activated sludge, contact stabilization activated sludge, pure oxygen activated sludge, aerated aerobic lagoons, aerated facultative lagoons, oxidation ditch, nutrification-denitrification, aerobic digestion, anerobic digestion and stabilization ponds. Factors determining process selection include stream standards and/or receiving water quality, federal state and local effluent criteria, wastewater characteristics, economics, availability of fuel and/or electric power, specific exclusions of certain processes and possible requirements for future expansion and/or upgrading. (Iervolino-NC)
W80-04773

EXOTIC TECHNIQUES HELP DRILLERS.
For primary bibliographic entry see Field 7B.
W80-04774

8B. Hydraulics

PROBABLE HYDROLOGIC EFFECTS OF A HYPOTHETICAL FAILURE OF MACKAY DAM ON THE BIG LOST RIVER VALLEY FROM MACKAY, IDAHO, TO THE IDAHO NATIONAL ENGINEERING LABORATORY,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-04551

8C. Hydraulic Machinery

HYBRID ENERGY SYSTEM: WIND AND WATER,
Nevada Univ. System, Reno. Desert Research Inst.
J. W. Fordham, M. K. Peck, R. McMullen, and A. B. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-171218, Price codes: A05 in paper copy, A01 in microfiche. Publication No 41062, February 1980. 74 p, 18 Fig, 7 Tab, 10 Ref, 1 Append. OWRT B-086-NEV(1), 14-31-0001-6098.

Descriptors: *Hydroelectric power, *Winds, *Energy conversion, *Reservoir storage, Powerplants, Electric power costs, Power operation and maintenance, Electric power rates, Nevada, Transmission lines, Wind velocity, Air circulation, Design criteria.

The potential for using wind together with hydro generation to meet small area energy demands was examined and a prototype wind-hydro system was modeled for a Nevada site to determine optimum component sizes and operation. The wind-hydro system is designed as an alternative to conventional power generation methods especially in remote areas where the construction of transmission lines is not economically practical. The system includes a reservoir to catch as much runoff as possible, a hydroelectric generation plant, a wind turbine, and a generator. To offset the variability of energy supply from the wind, wind energy conversion systems (WECS) drive recharge pumps to the upstream reservoir where water is stored to be released to drive the hydroelectric generators when needed for a steady energy supply. Costs and benefits are examined in a generalized manner for six preliminary designs then in detail for a wind-hydro system located on Slide Mountain in Nevada. Major points of wind-hydro consideration resulting from the site specific study include: the availability and reliability of wind data, ice accumulation on the WECS structure, WECS cost reduction, pump cost estimates, penstock and recharge pipe assumptions, reservoir costs, reservoir losses, streamflow characteristics, and the market value of power. The wind-hydro system can be a profitable alternative that employs a free, inexhaustible, nonpolluting form of energy. (Seigler-IPA)
W80-04502

EVALUATION AND DESIGN OF DOWNHOLE HEAT EXCHANGERS FOR DIRECT APPLICATION,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
G. Culver, and G. M. Reistad.
Geo-Heat Utilization Center Quarterly Bulletin; Vol 1, No 3, August, 1975. 12 p, 16 Fig, 2 Tab, 2 Ref.

Descriptors: *Geothermal studies, *Heat exchangers, *Shallow wells, *Mathematical models, Design, Economics, Energy equation, Convection, Mixing, Discharge(Water), Flow measurement.

The results of a study of the design and economics of downhole heat exchanger (DHE) systems are presented. Energy balance calculations and measurements of convection cell circulation in hot wells were used to develop analytical models to predict heat extraction rates with and without a DHE. In general, increases in source temperature, well diameter, and mass flow rate provide increased energy extraction rates. Mixing of new and circulating well water can be calculated but not accurately predicted before testing a well. Multitube heat exchangers were designed and tested with outputs within 15% of the values predicted by the analytical models. Economic analyses indicate that for small to moderate withdrawal rates from shallow wells and about 300 KW thermal, DHE's may be more economical than pumped systems when surface discharge is not acceptable. (Purdin-NWWA)
W80-04764

STUDIES AIM AT OPTIMUM DESIGN FOR PDC HARD-FORMATION BITS,
Sandia Lab., Albuquerque, NM.
S. G. Varnado, C. F. Hunt, and P. Yarrington.
World Oil, Vol 190, No 4, p 63-66, 70, March, 1980. 8 Fig, 33 Ref.

Descriptors: *Drill bits, *Geothermal studies, *Laboratory tests, *On-site tests, Computer models, Stress analysis, Design, Bonding, Penetration, Crystalline rock.

Geothermal drill bits using polycrystalline diamond compact (PDC) cutters have the potential for increasing penetration rate and reducing the cost of drilling. The results of single cutter tests, bit design, bonding of cutters to the bit body, and lab and field tests on new bit designs are described. A computer program was developed to model the stresses induced into the tool by the tool-rock interaction and to design the optimum cutting structures. Main problem areas identified during testing are: attachment of cutters to the tool post or to the bit body directly; and potential for tool post breakage in field drilling operations. (Purdin-NWWA)
W80-04767

8G. Materials

DIAMOND COMPACT CUTTER STUDIES FOR GEOTHERMAL BIT DESIGN,
General Electric Corporate Research and Development, Schenectady, NY. Physical Chemistry Lab.
L. E. Hibbs, Jr., and D. G. Flom.
Journal of Pressure Vessel Technology, Vol 100, No 11, p 406-416, November, 1978. 17 Fig, 4 Tab, 7 Ref.

Descriptors: *Drilling equipment, *Geothermal studies, *Laboratory tests, Penetration, Rock excavation, Research and development, Design data, Abrasion, Rotary drilling.

Rock cutting studies using diamond compact cutters were undertaken to determine the following relationships needed in designing a more efficient geothermal bit: (1) the effect of cutter size on rate of material removal and on torque, (2) the effect of the degree of cutter overlap on cutting efficiency; (3) penetration rate as a function of rotational speed and cutter size; (4) the effect of rotational speed on force and cutter wear rate; (5) the effect of cutter geometry on penetration rate, force, and cutter wear rate; and (6) variations of these parameters as required by the range of rock properties encountered in geothermal formations. Rake angles affected cutting efficiency at light cuts but were less significant at high penetration forces. In continuous turning, cutter forces exhibit regular, repeated variations due to the rock undergoing alternate crushing and fracturing. In interrupted cutting, the variations in forces are no greater than in continuous cutting. Thus, force fluctuations when cutting a composite of hard and soft rock should not be significantly greater than those generated in cutting each rock separately. The effects of changing speed were not as great as those of geometry and depth of cut. (Purdin-NWWA)
W80-04531

THE EVALUATION OF A SYNTHETIC MATERIAL FOR USE AS A WAVE PROTECTION AGENT ON IRRIGATION DAMS,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
R. W. Stephenson, L. D. McCallister, and D. L. Dutton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173586, Price codes: A08 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Completion Report, March 1980. p 162, 79 Fig, 11 Tab, 117 Ref, 4 Append. OWRT B-122-MO(2), USDI-OWRT-14-34-0001-8095.

Descriptors: *Earth dams, Erosion, Dams, Filter fabrics, Models, Reservoirs, Shore protection, Waves(Water), Protection, *Irrigation dams, *Slope protection, Model studies, *Bank protection, *Sand pillows.

This report presents the results of a field and laboratory testing program to evaluate the performance of a slope protection method utilizing a new synthetic fabric material in the form of soil filled bags. The results of this investigation indicate that the system is readily installed on irrigation dams and offers excellent slope protection. The factors which influence the practicality of the system include the cost of alternate slope protection methods, the position of the irrigation dam in relation to local winds and the availability of fill material for the bags. A medium-scale laboratory model study was performed on a new synthetic fabric designed to be used in the form of soil-filled 'sand pillows' in order to determine the relationship that affect the stability of the pillows and to determine basic design criteria for the protection system. Laboratory tests were conducted to determine the soil retention characteristics of the fabric. The results of the model study investigation indicate that the stability of sand pillows is primarily a function of wave height, wave period, embankment slope angle, and individual sand pillow

weight. A possible design equation was developed for a silty clay soil such that the wave height calculated for a given reservoir could be utilized to determine the weight of the individual sand pillow necessary to economically and effectively protect the embankment.
W80-04599

WELL GROUTING AND CASING TEMPERATURE INCREASES,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W80-04650

GROUNDWATER CHARACTERISTICS AND CORROSION PROBLEMS ASSOCIATED WITH THE USE OF GEOTHERMAL WATER IN KLAMATH FALLS, OREGON,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
J. W. Lund, G. Culver, and P. J. Lienau.
Geo-Heat Utilization Center Quarterly Bulletin, Vol 3, No 2, May, 1977. 17 p, 4 Fig, 6 Tab, 10 Ref.

Descriptors: *Geothermal studies, *Corrosion, *Water chemistry, *Materials testing, Scaling, Temperature, Corrosion control, Well casings, Heat exchangers, Regression analysis, Geochemistry, Ions, Steel pipes.

This report presents the results of two investigations of corrosion of downhole heat exchangers. In one study, temperature and chemistry data for over 100 wells were collected and correlated with heat exchanger service life. Contrary to results of other corrosion studies, high temperature was related to longer service life. However, this may be due to some other factor related to high temperature. Corrosion and scaling of well casing is not as severe as that of heat exchangers since fluid production through the casing is not required. Corrosion occurs at the air/water interface and can be effectively reduced by pouring oil or wax in the well. In the second study, corrosion rates for various materials were determined from coupon tests in well water with temperatures ranging from 32 to 49C, pH between 7.1 and 8.2, and total dissolved solids content of about 800 ppm. Mild steel had low resistance to corrosion. Ions having the highest correlation with corrosion rate were sodium, water hardness, chloride, sulfate, and pH. (Purdin-NWWA)
W80-04763

STUDIES AIM AT OPTIMUM DESIGN FOR PDC HARD-FORMATION BITS,
Sandia Lab., Albuquerque, NM.
For primary bibliographic entry see Field 8C.
W80-04767

8H. Rapid Excavation

DIAMOND COMPACT CUTTER STUDIES FOR GEOTHERMAL BIT DESIGN,
General Electric Corporate Research and Development, Schenectady, NY. Physical Chemistry Lab.
For primary bibliographic entry see Field 8G.
W80-04531

EXOTIC TECHNIQUES HELP DRILLERS.
For primary bibliographic entry see Field 7B.
W80-04774

8I. Fisheries Engineering

IMPROVING STREAM FISHERIES,
Oklahoma State Univ., Stillwater.
O. E. Maughan, and K. L. Nelson.
Water Spectrum, Vol 12, No 2, p 11-15, Spring 1980. 5 Fig, 5 Ref.

Descriptors: *Virginia, *Stream improvement, *Fish management, *Stream fisheries, *Hydraulic structures, Gabions, Dams, Boulders, Trout, Aquatic environment, Biomass, Productivity, Streamflow, Diversion, Runoff, Scour.

Stream physical characteristics, aquatic macroinvertebrates, and fish population in four Virginia streams, North Creek, Jennings Creek, Comers Creek, and Crooked Creek were evaluated to compare improved and unimproved river sections. Various techniques used to improve fishery conditions by increasing pool area and cover amounts in the stream include log dams, boulder enplacements, and gabion deflectors. All of the streams are typical trout waters with rapid flow along mountain slopes. Due to the mountain setting rapid runoff and periodic flooding are common. All of the streams flow through forested land except Crooked Creek which is affected by livestock grazing and adverse agricultural practices. Log dams in North Creek did increase pool area by about 7% but due to improper placement of some of the dams and lack of increased cover the results are not conclusive. Some increases in total biomass were recorded for the improved sections of the stream. The gabions on Jennings Creek did appear to promote pool formation but lack of pregabion data makes accurate assessment difficult. Five of the twelve boulder placements in Crooked Creek did result in undercutting and pool formation. Some negative results of the improvement methods include deposition of sand behind boulders and bank erosion during high flow. Gabions and log dams were susceptible to high flow destruction and did not provide cover. Boulders provide cover but stream depth is a major factor and boulders may be impractical if not readily available. (Seigler-IPA)
W80-04506

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
For primary bibliographic entry see Field 6E.
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04593

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

HYDROLOGY RESEARCH DIVISION--ANNUAL PROGRESS REPORTS AND SHORT RESEARCH NOTES 1977-78.
Department of Fisheries and Environment, Ottawa (Ontario). Water Resources Branch.
Report Series No 64, 1979. 117 p, 33 Fig, 10 Tab.

Descriptors: *Water quality, *Water quality parameters, *Hydrogeology, *Canada, *Groundwater pollution, Hydrothermal studies, Models, Computer programs, Data retrieval, Well injection, Water pollution, Groundwater, Acquifers, Irrigation, Design flow, Reservoirs, Runoff forecasting.

Results of 29 studies of water quality and water quantity are presented. Included are hydrogeological studies of the effects of open-pit mining and dewatering, a salmon enhancement program, a wildlife preserve, inland wetlands sites, and the hydrogeology of the Fraser Valley. Hydrologic modelling studies presented include: streamflow simulation, evaporation and runoff, mathematical modelling of a wellfield, snowmelt infiltration and runoff, and irrigation return flow amounts and rates. The Bowen-ratio evapotranspiration estimates project is described; an experimental system was set up at Perch Lake during 1977. Inconclusive results were obtained due to system electrical interference. Groundwater studies summarized covered arsenic contamination sites and amounts, and existing groundwater trace element parameters such as pH, Eh, dissolved oxygen, temperature, and major anions and cations in order to assess their influence on trace element migration. Results of use of the GOWN computer program and its ability to document and retrieve data are summarized. A project studying hydrothermal effects in areas adjacent to Artic streams is described, and results of field dispersion tests at the Chalk River Nuclear Laboratories are presented. (Arnold-NC)
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*U.S. GOVERNMENT PRINTING OFFICE : 1980 O-311-059/1

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A02	5.00	E02	6.50	T02	125.00
A03	6.00	E03	8.50	T03	210.00
A04	7.00	E04	10.50	T04	300.00
A05	8.00	E05	12.50	T05	360.00
A06	9.00	E06	14.50	T06	420.00
A07	10.00	E07	16.50	T07	480.00
A08	11.00	E08	18.50	T08	540.00
A09	12.00	E09	20.50	T09	600.00
A10	13.00	E10	22.50	T10	660.00
A11	14.00	E11	24.50	T11	720.00
A12	15.00	E12	27.50	T12	780.00
A13	16.00	E13	30.50	T13	840.00
A14	17.00	E14	33.50	T14	900.00
A15	18.00	E15	36.50	T15	960.00
A16	19.00	E16	39.50	T16	1,020.00
A17	20.00	E17	42.50	T17	1,080.00
A18	21.00	E18	45.50	T18	1,140.00
A19	22.00	E19	50.50	T19	1,200.00
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